National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

A Comparison of Calculated and Cloud-Cleared Radiances Over Land and Water

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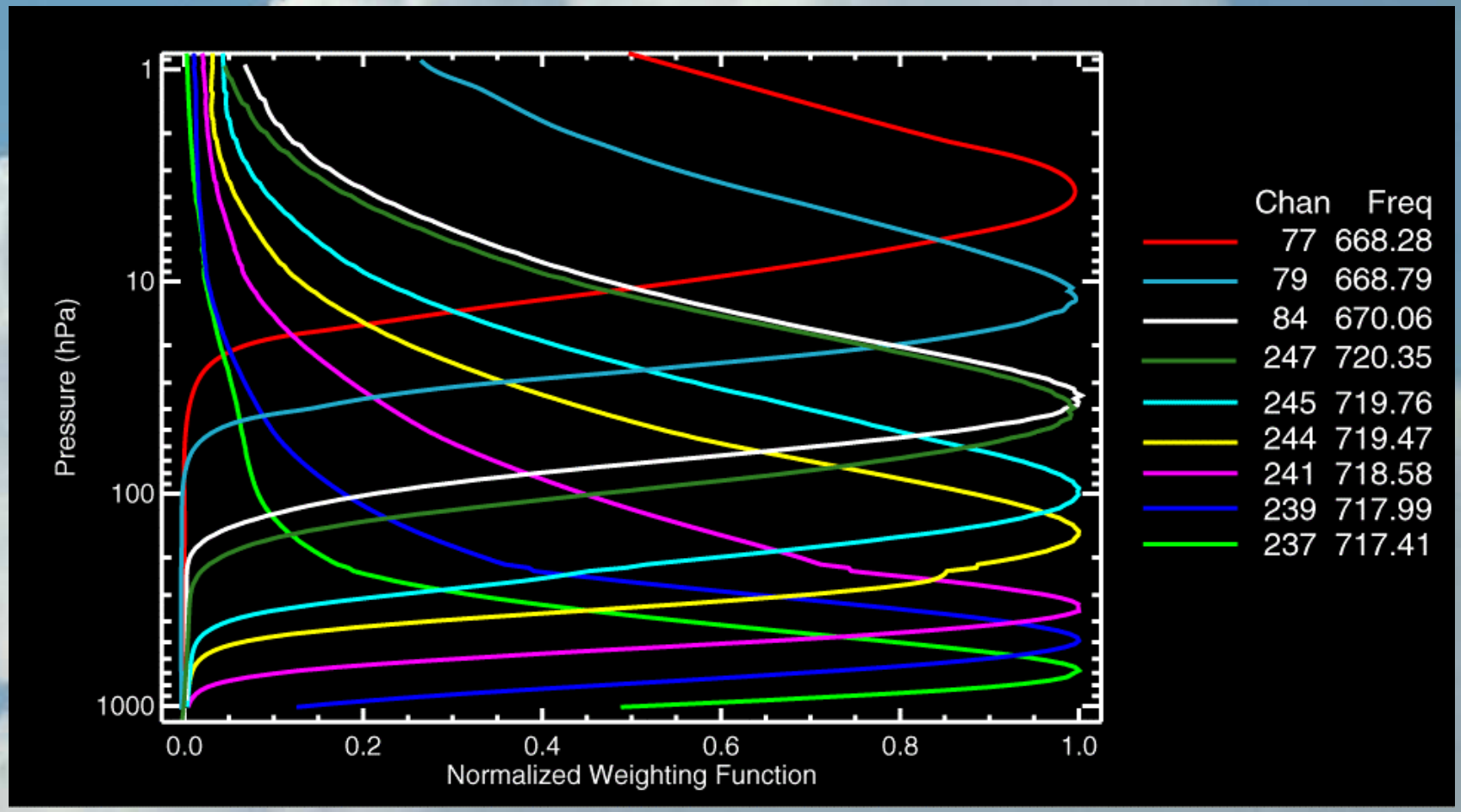
JPL

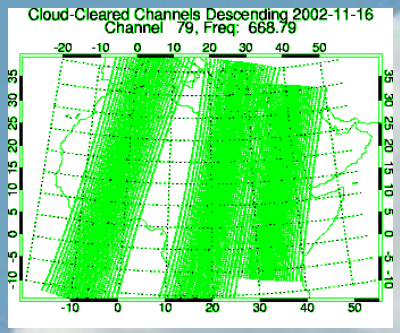
1. Height dependence of observed minus Calculated Radiances from ECMWF

Atmospheric Sounding Channels

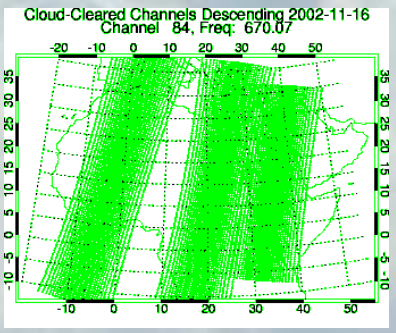


North Africa
Atmospheric Radiances Differences

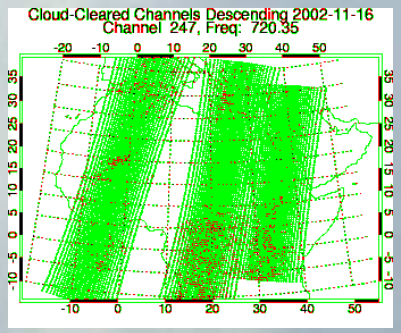
12 hPa



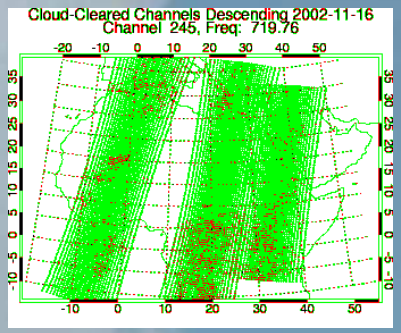
35 hPa



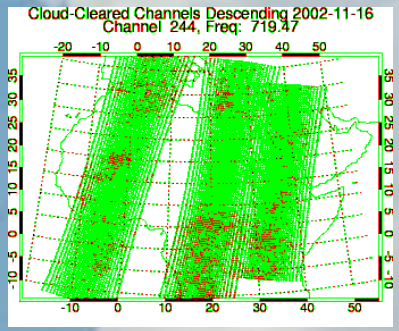
40 hPa



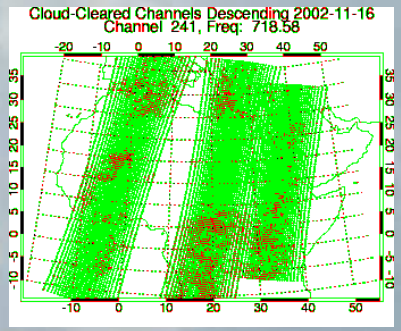
100 hPa



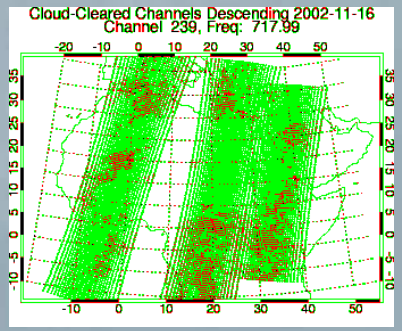
150 hPa



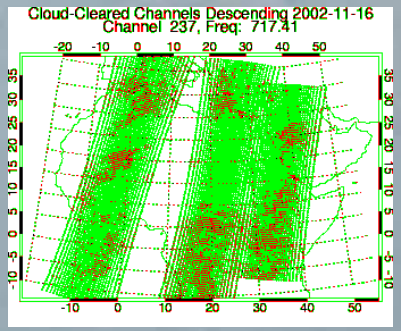
340 hPa



490 hPa



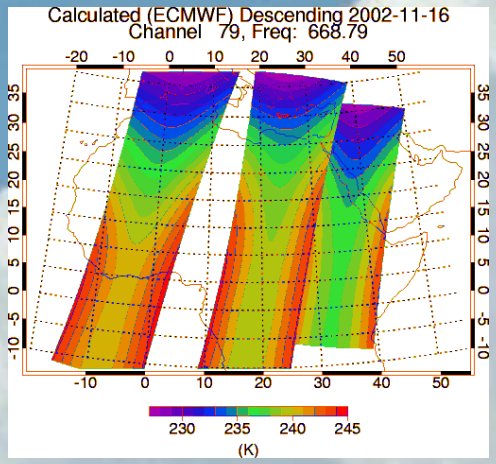
690 hPa

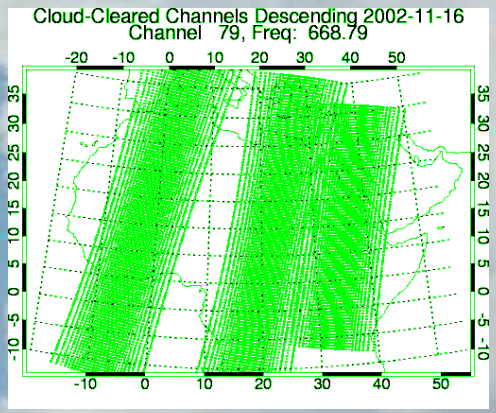


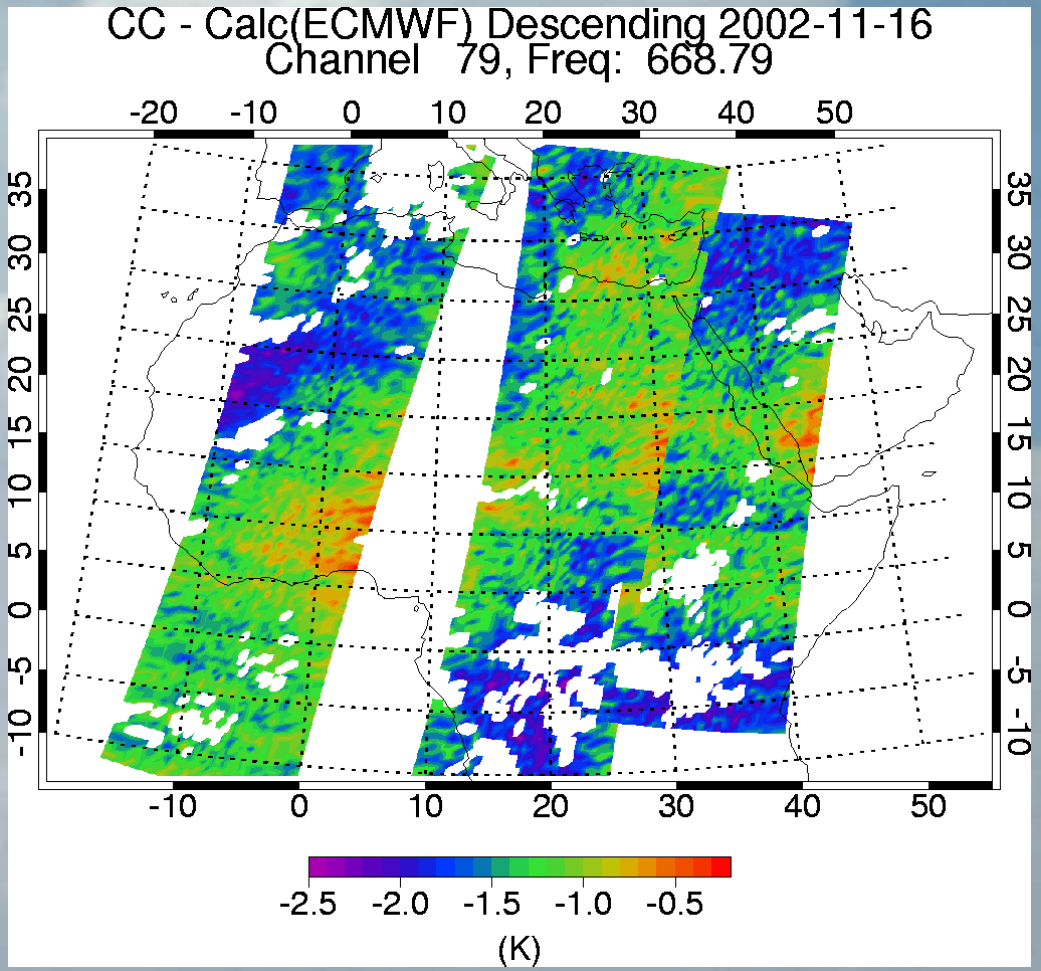
Spatial coherency of cloud clearing versus height of cloud-cleared minus average footprint radiance

Channel 79 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 79, 668.79 cm^{-1} , 12 hPa**

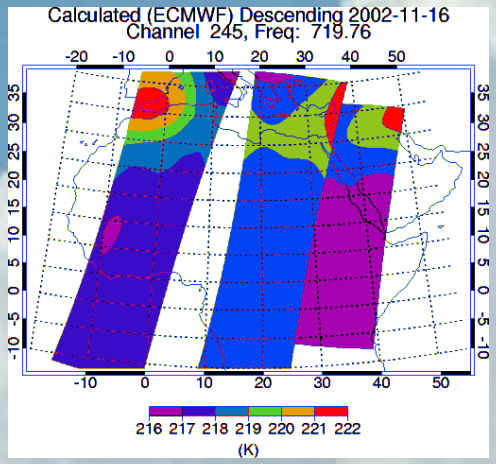


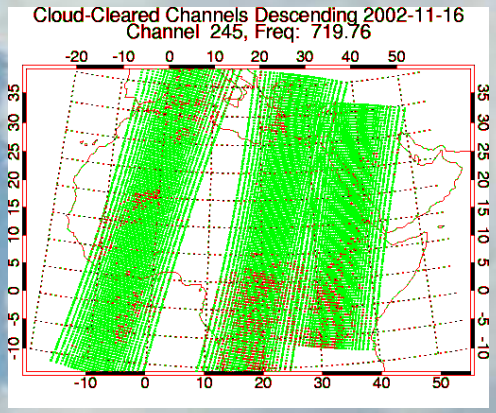


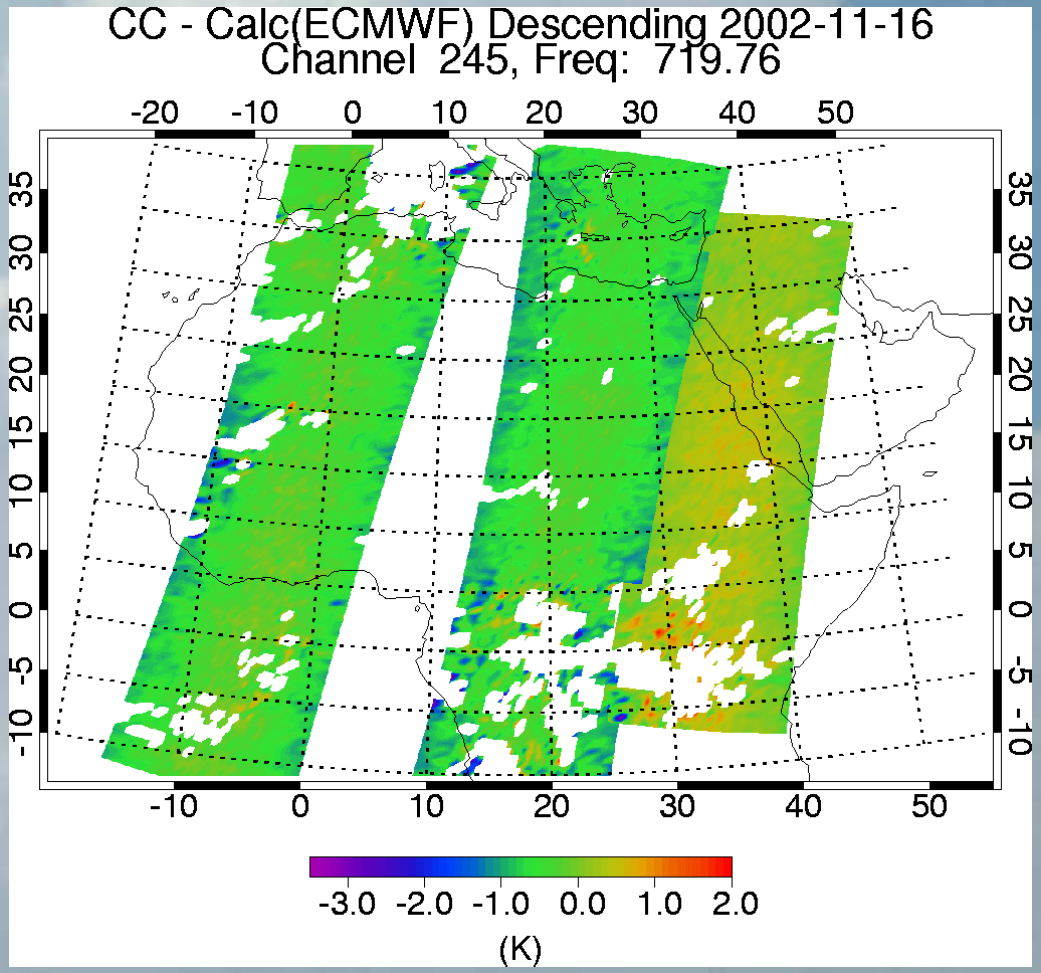


Channel 245 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 245, 719.76 cm^{-1} , 100 hPa**

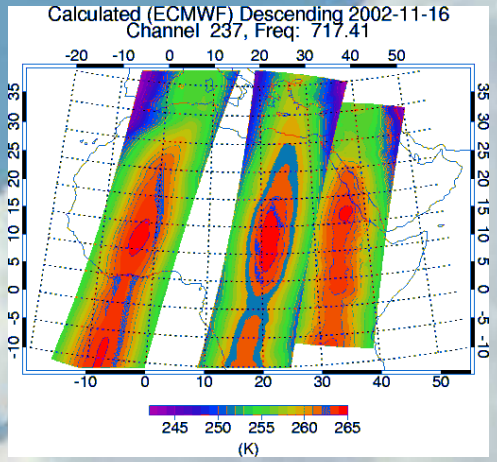


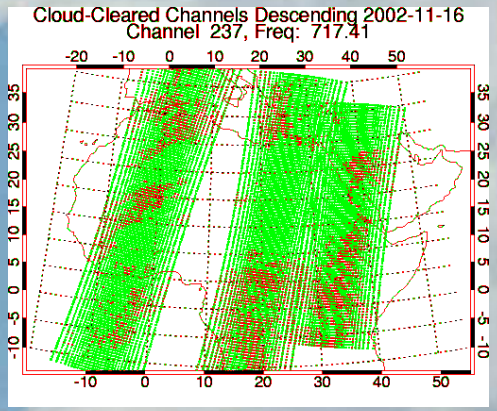


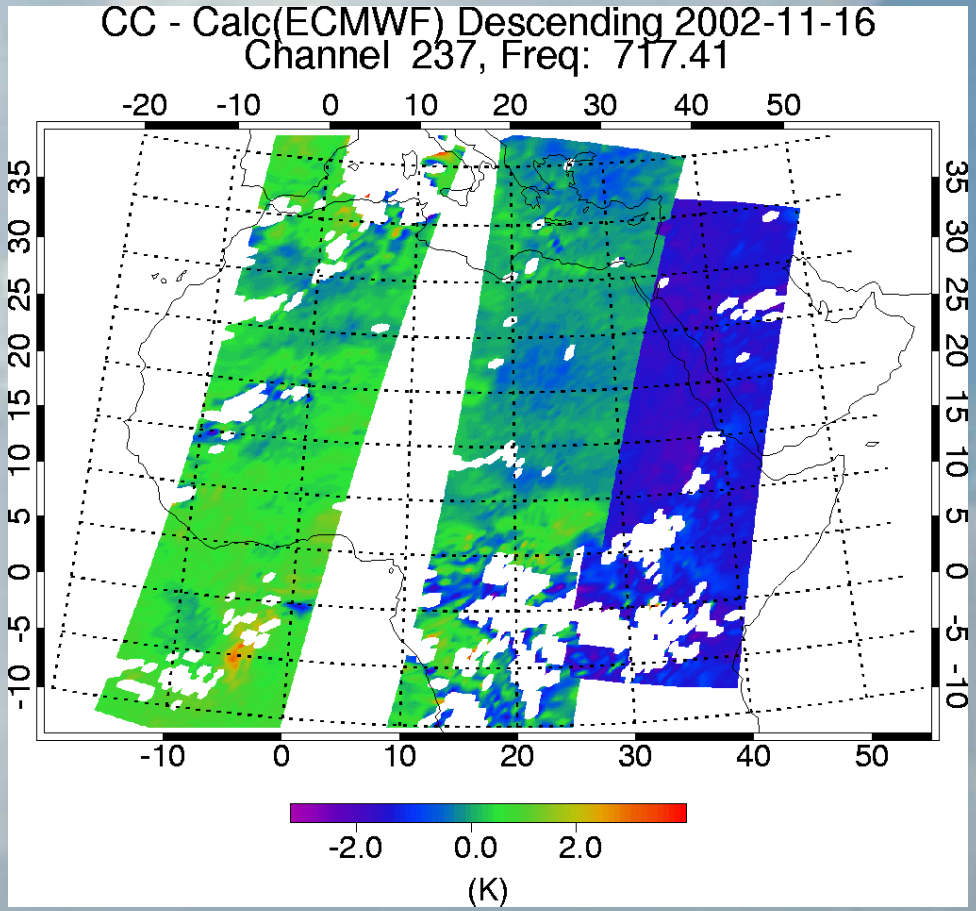


Channel 237 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 237, 717.41 cm^{-1} , 690 hPa**

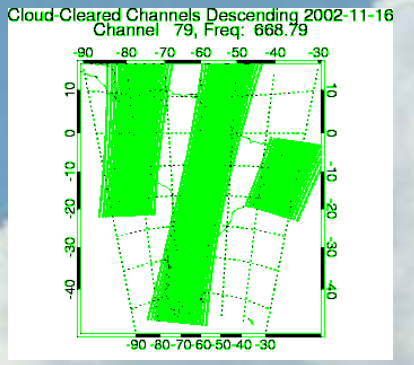




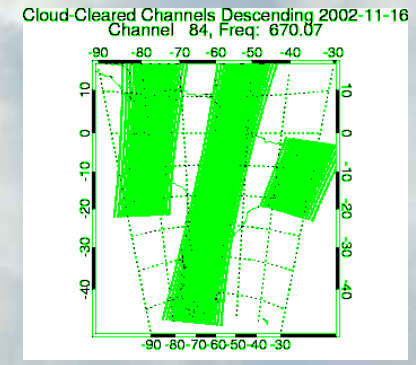


South America
Atmospheric Radiances Differences

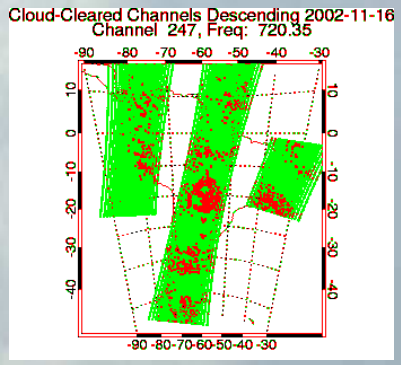
12 hPa



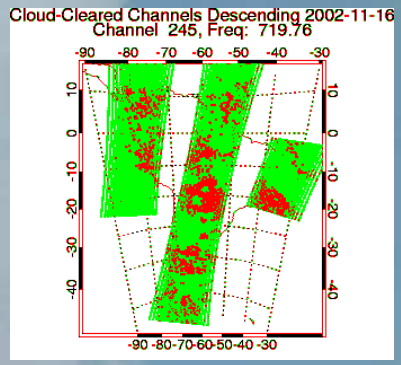
35 hPa



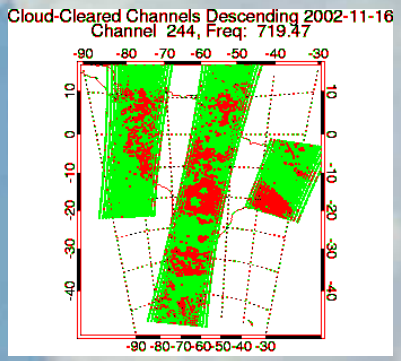
40 hPa



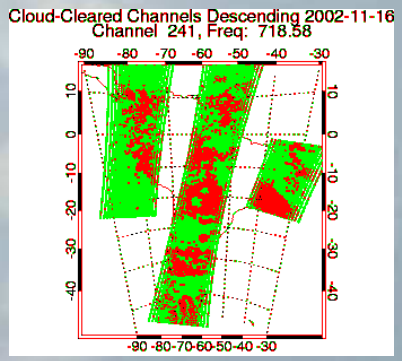
100 hPa



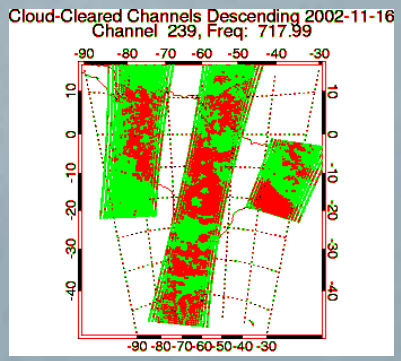
150 hPa



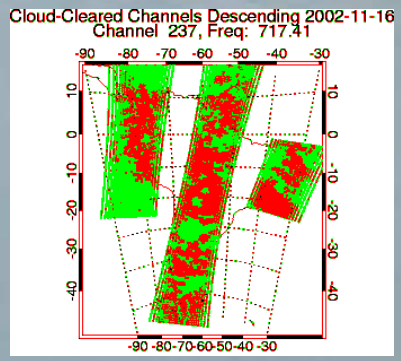
340 hPa



490 hPa

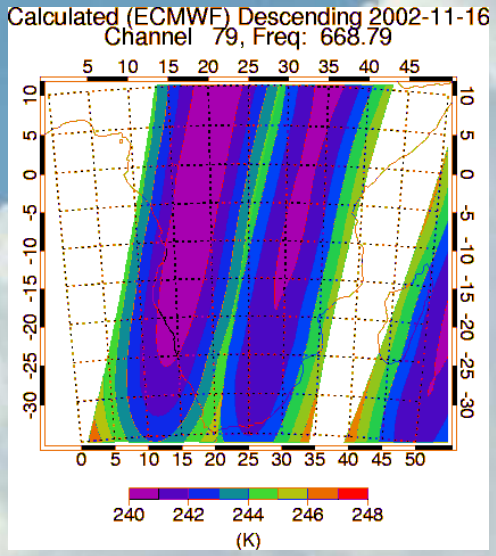


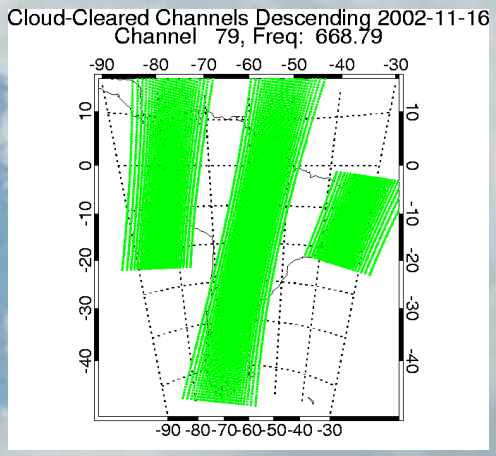
690 hPa

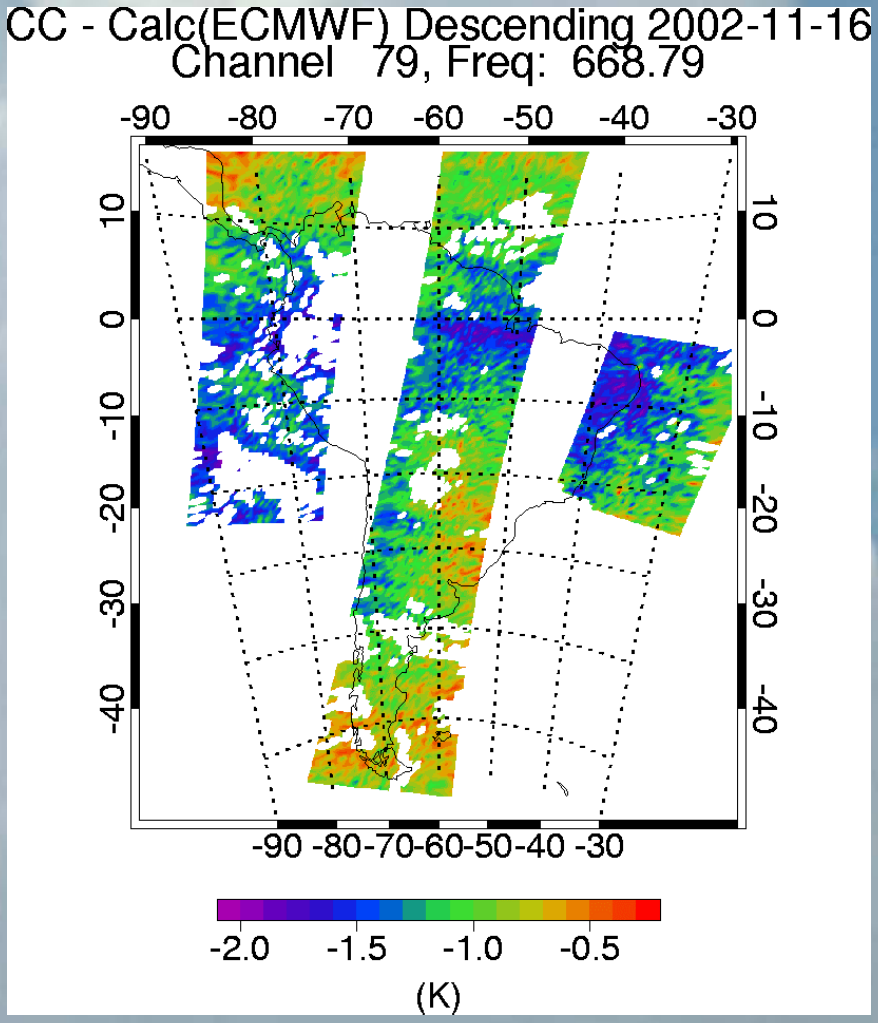


Channel 79 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 79, 668.79 cm^{-1} , 12 hPa**

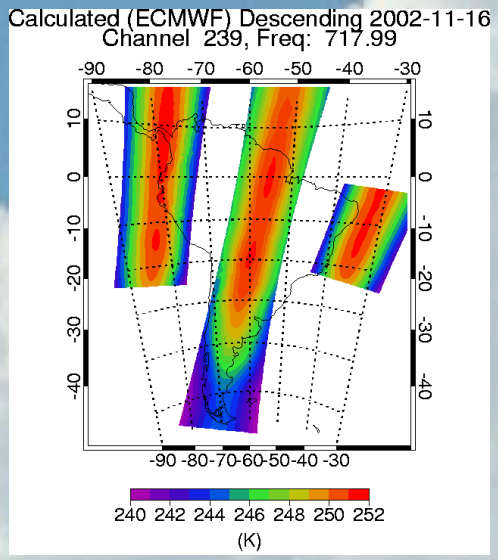


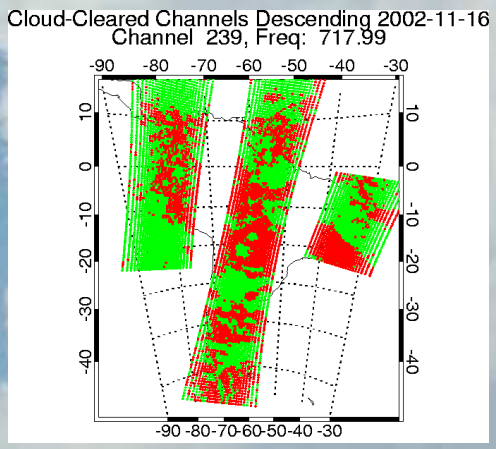


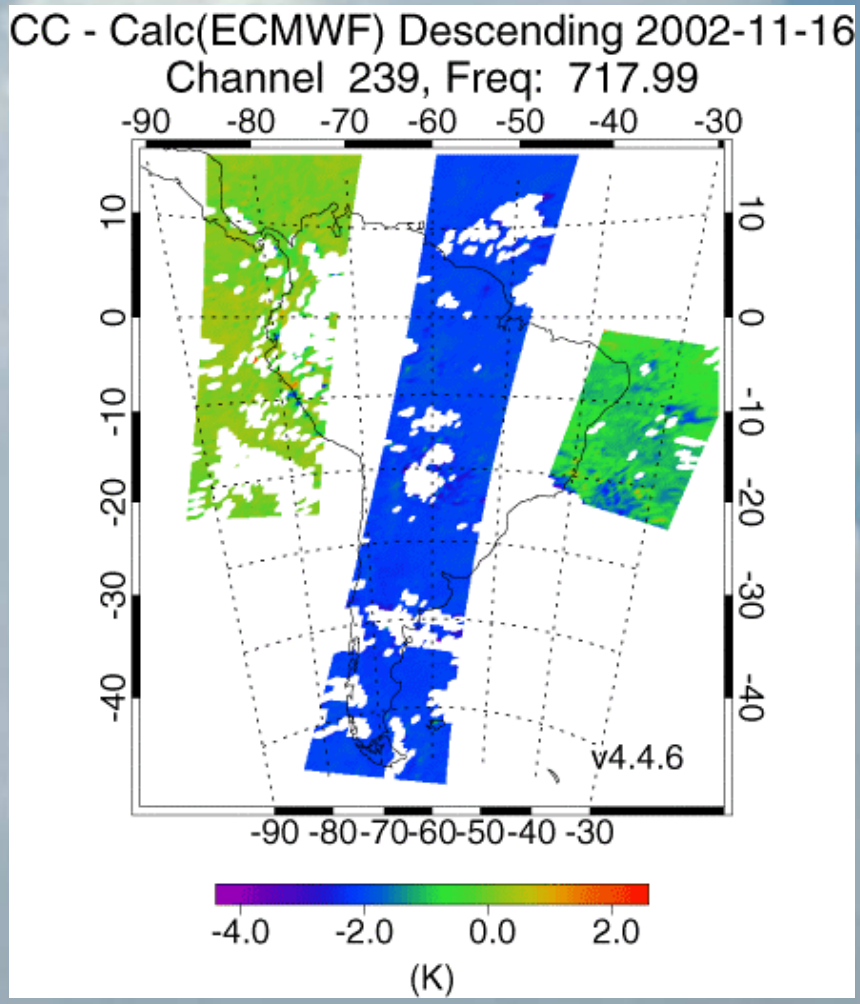


Channel 239 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 239, 717.99 cm^{-1} , 490 hPa**

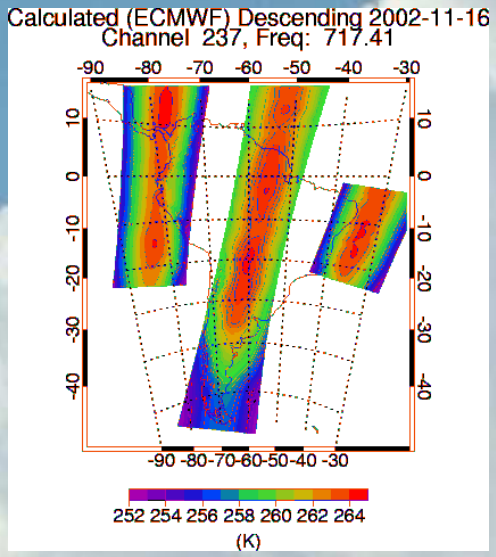


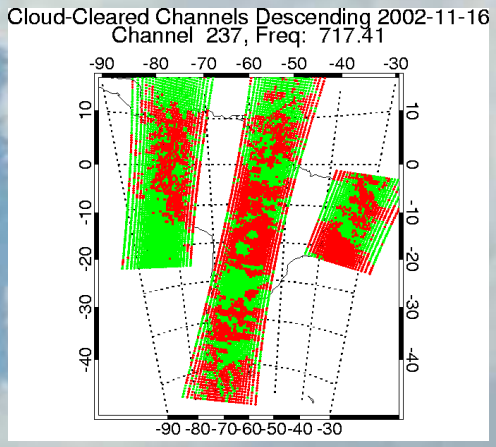


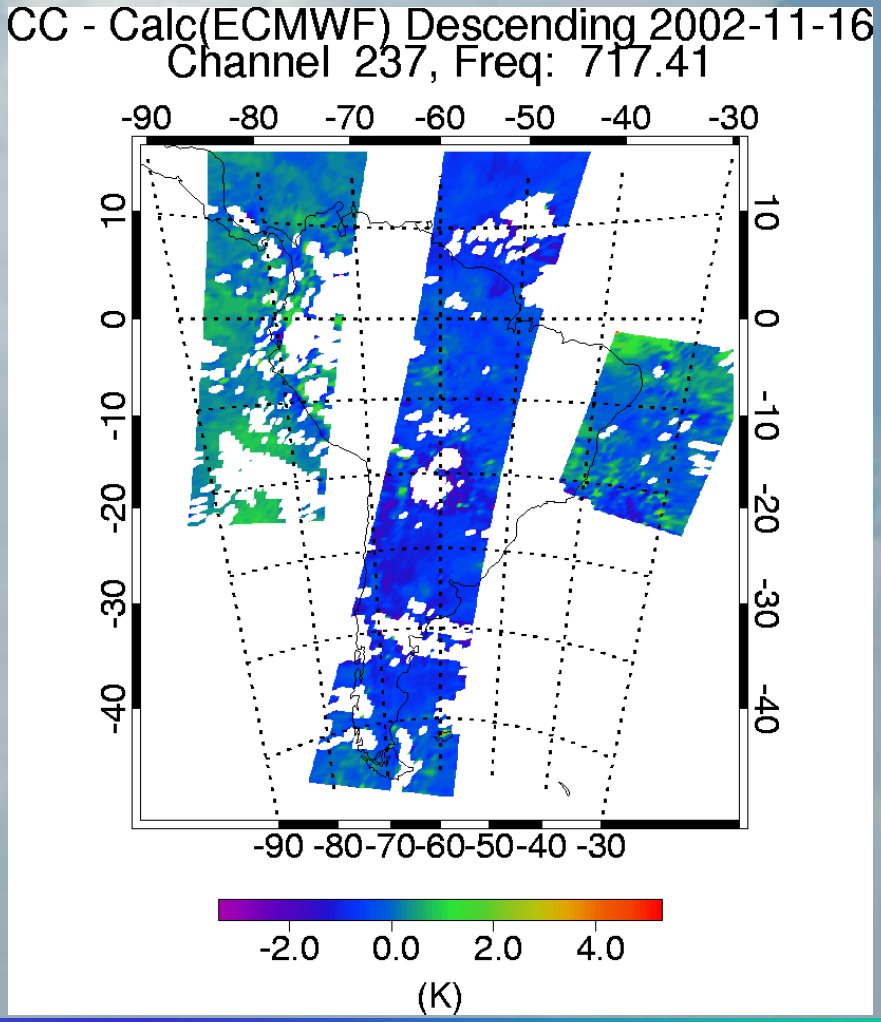


Channel 237 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 237, 717.41 cm^{-1} , 690 hPa**

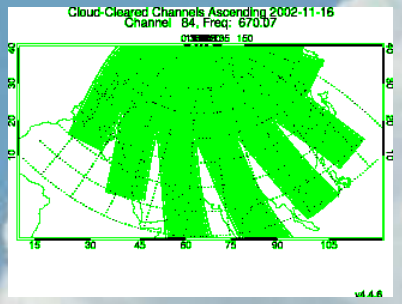




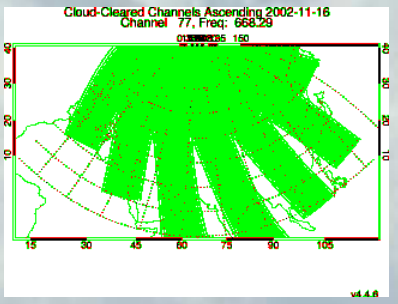


ASIA

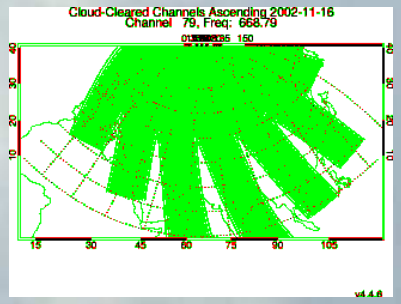
12 hPa



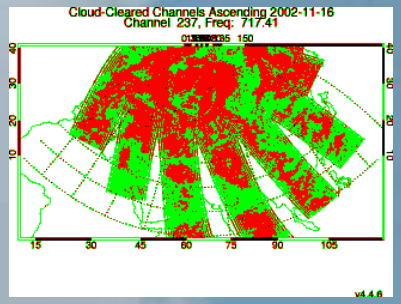
35 hPa



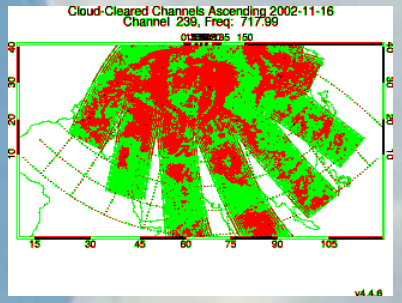
40 hPa



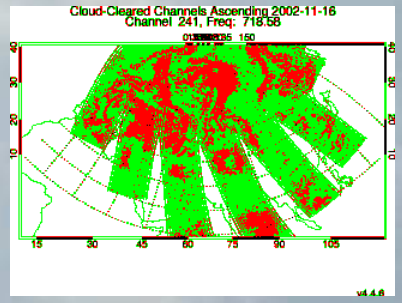
100 hPa



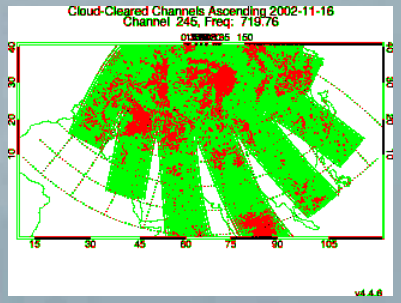
150 hPa



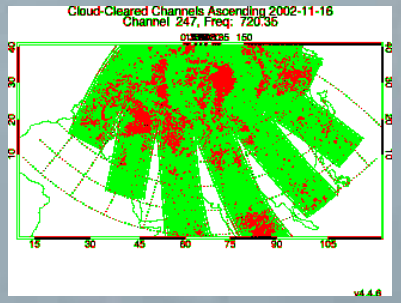
340 hPa



490 hPa

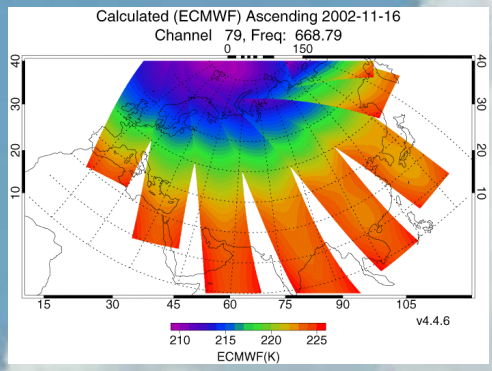


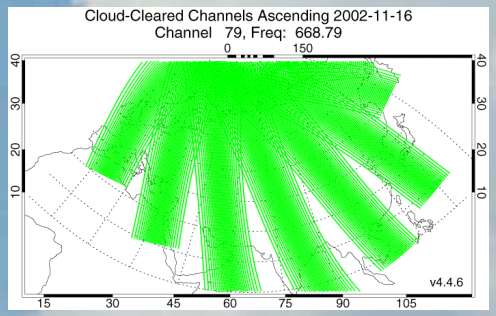
690 hPa

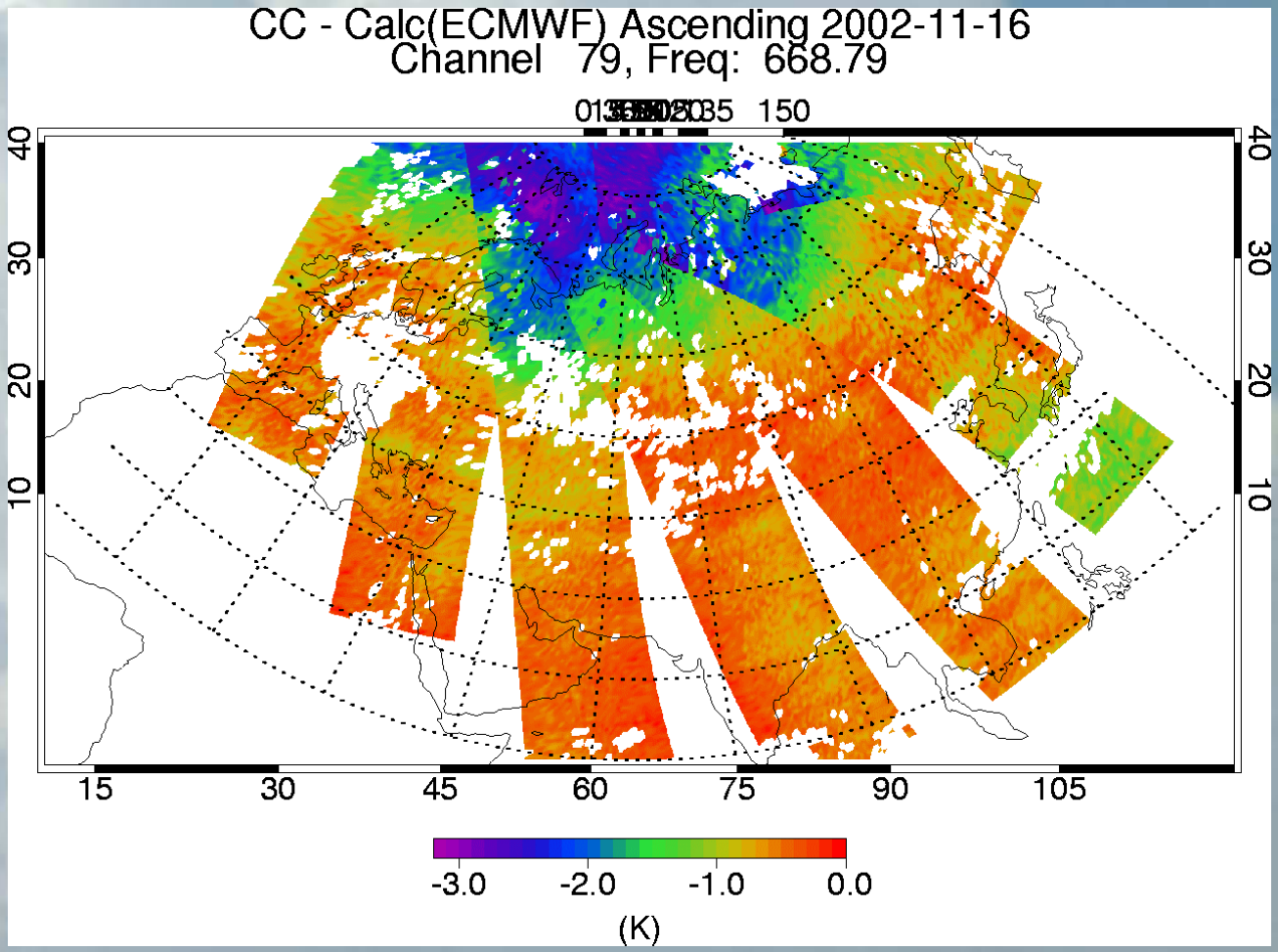


Mapped Calculated Radiances
Asia Channel 79

- **Channel 79 668.79 cm^{-1} 12 hPa**

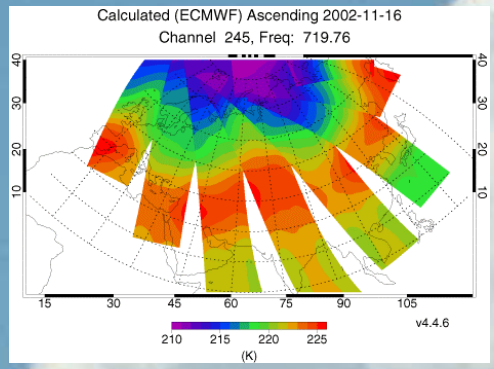


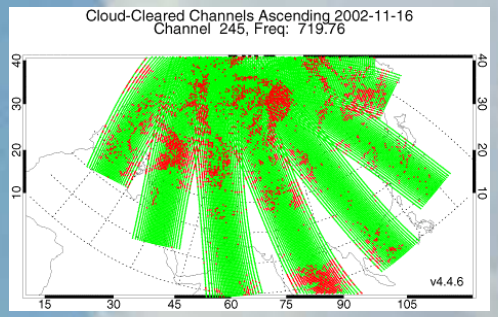


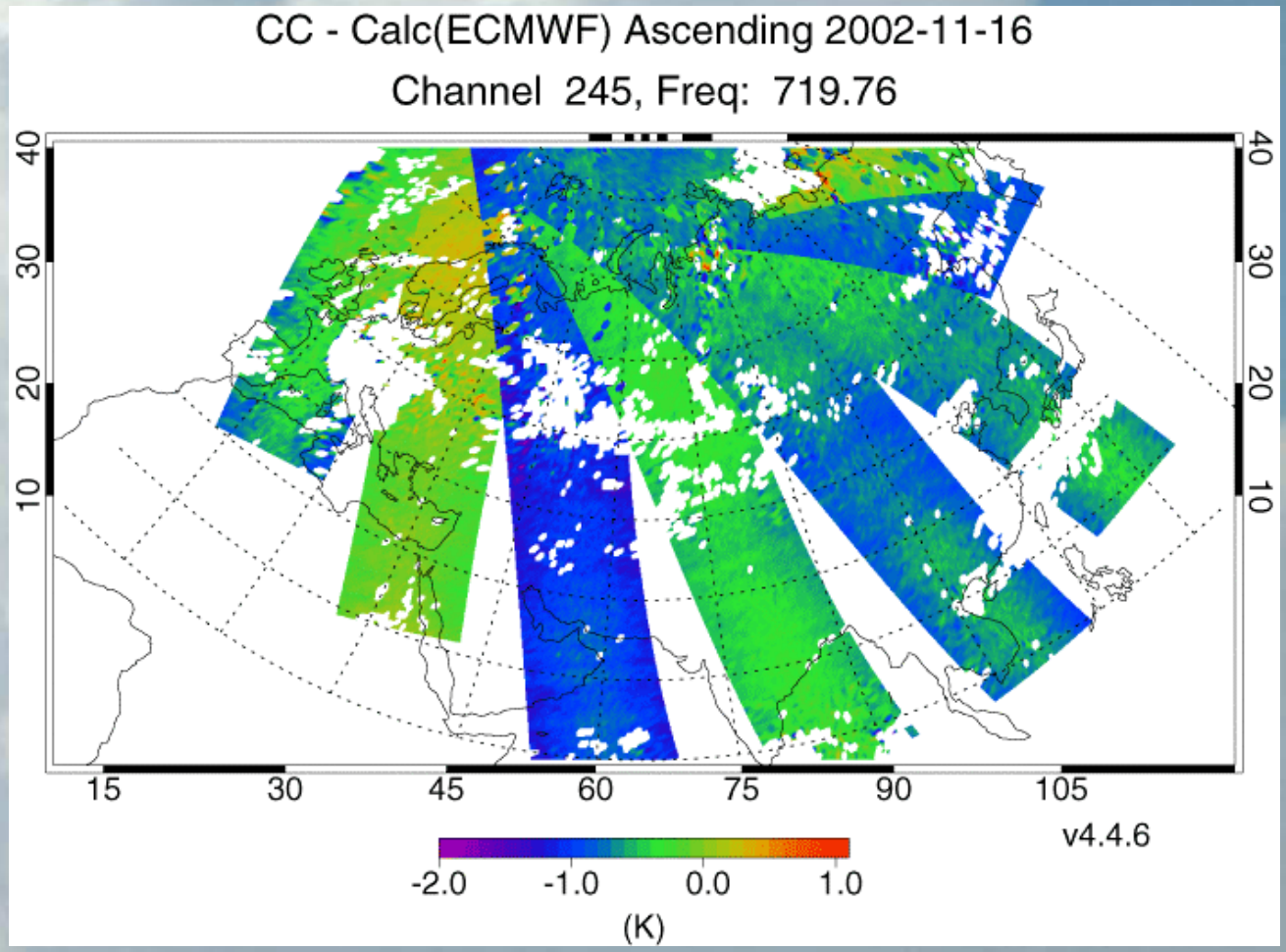


Mapped Calc(ECMWF) - CC Radiances
Asia Channel 245

Channel 245 719.76 cm^{-1} 100 hPa

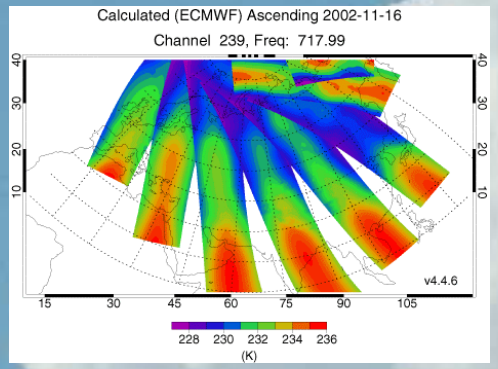


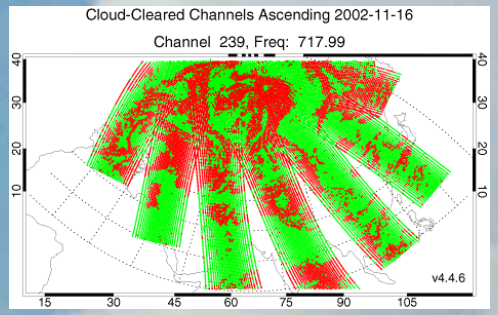


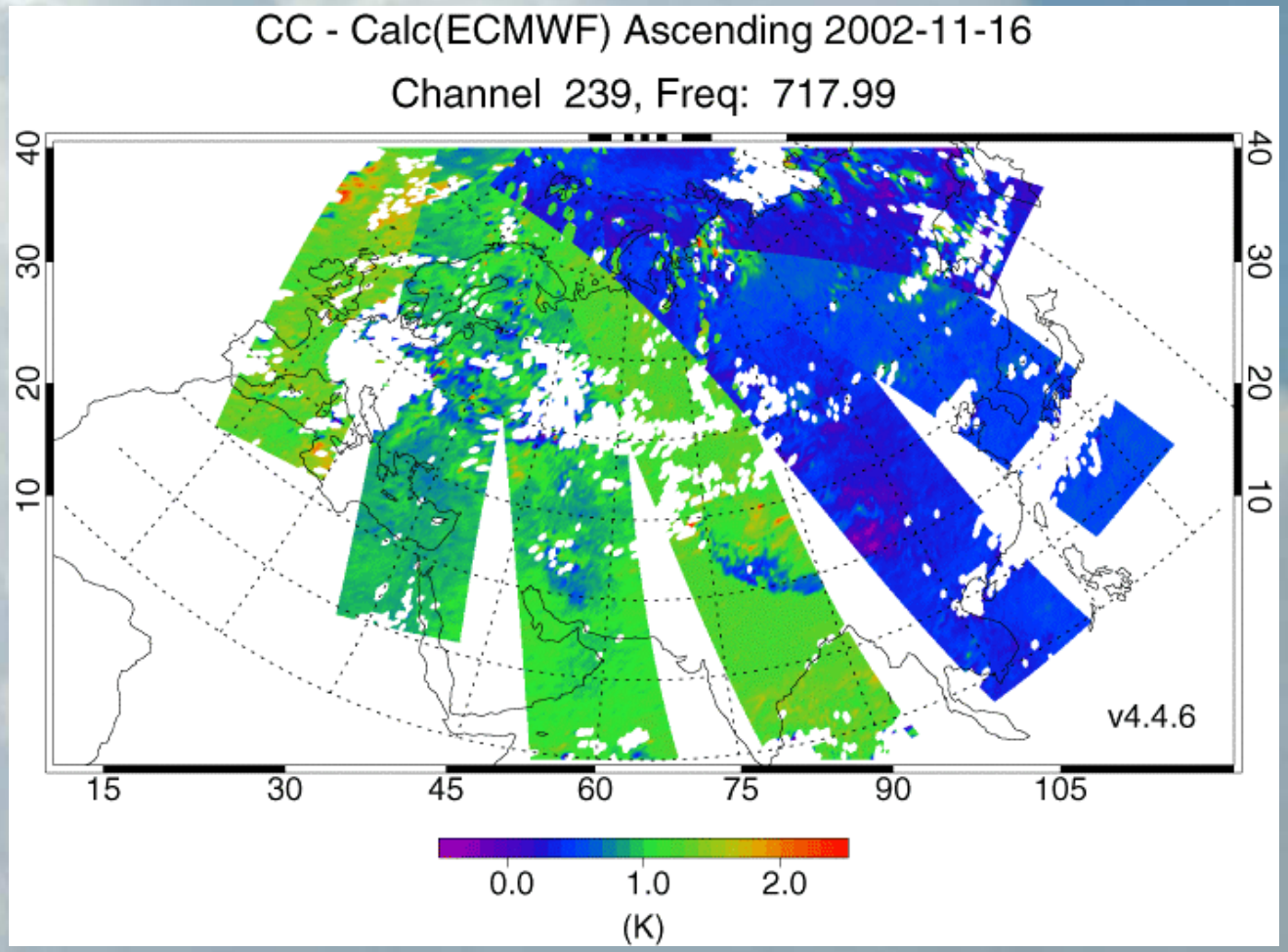


Mapped Calc(ECMWF) - CC Radiances
Asia Channel 239

Channel 239 717.99 cm^{-1} 718 hPa

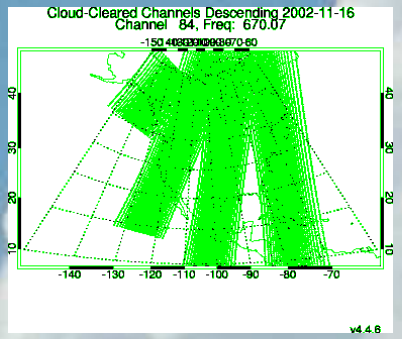




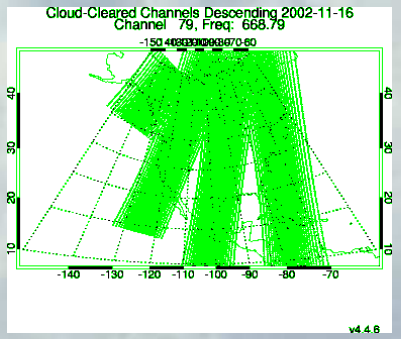


North America

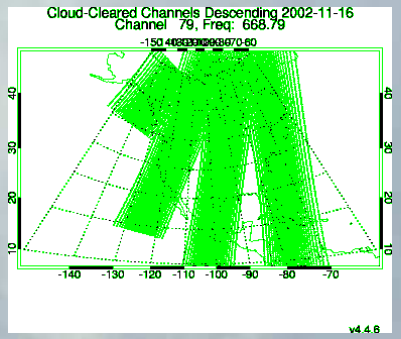
12 hPa



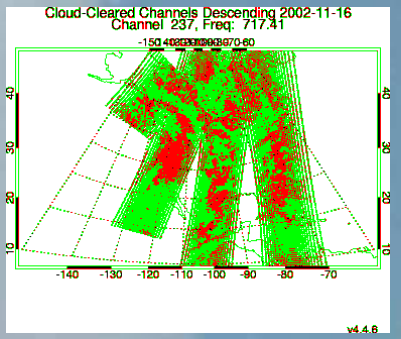
35 hPa



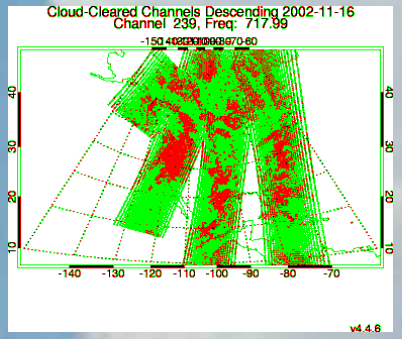
40 hPa



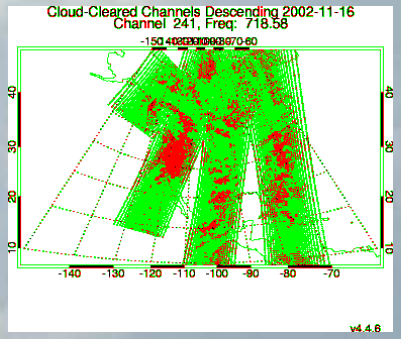
100 hPa



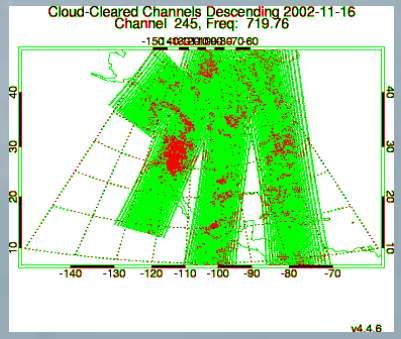
150 hPa



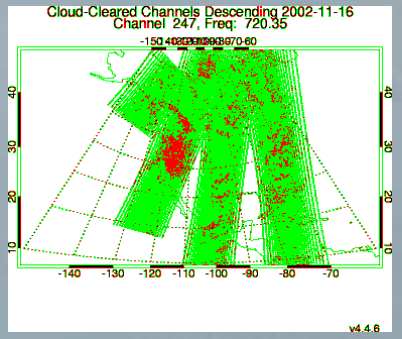
340 hPa



490 hPa

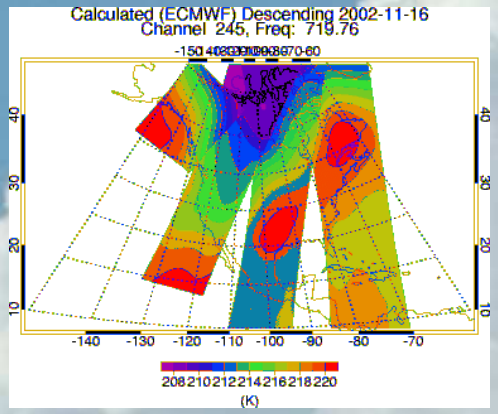


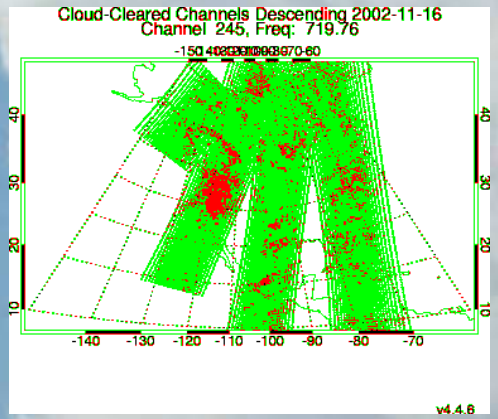
690 hPa

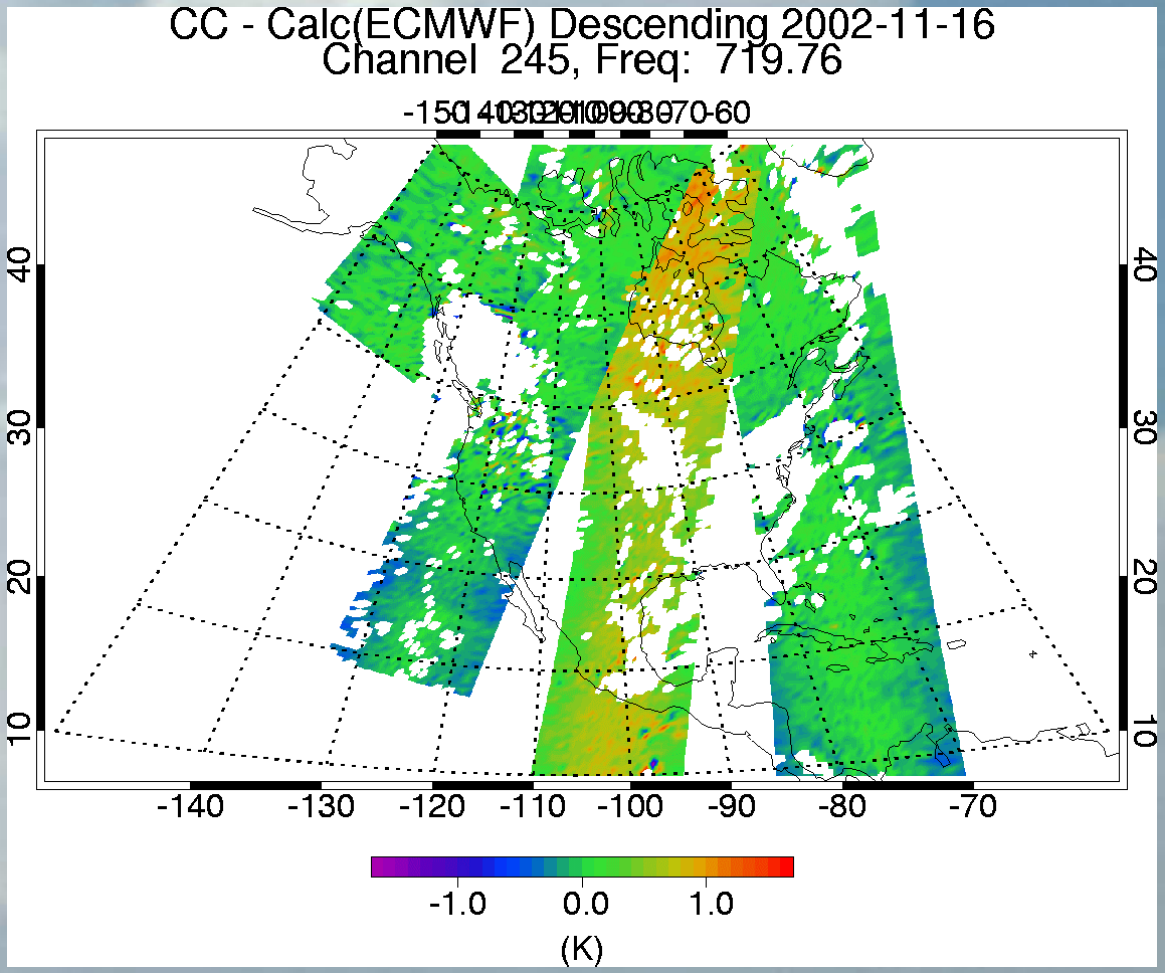


Mapped Calc(ECMWF) - CC Radiances
North America Channel 245

Channel 245 719.76 cm^{-1} 100 hPa

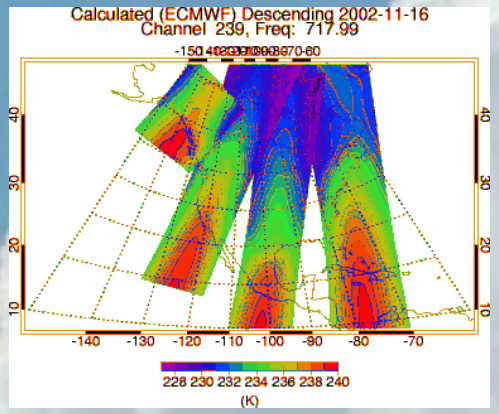


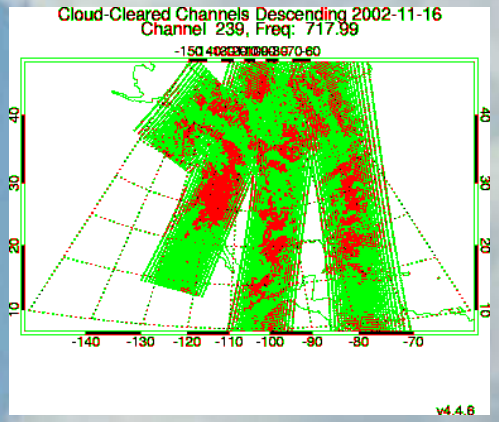


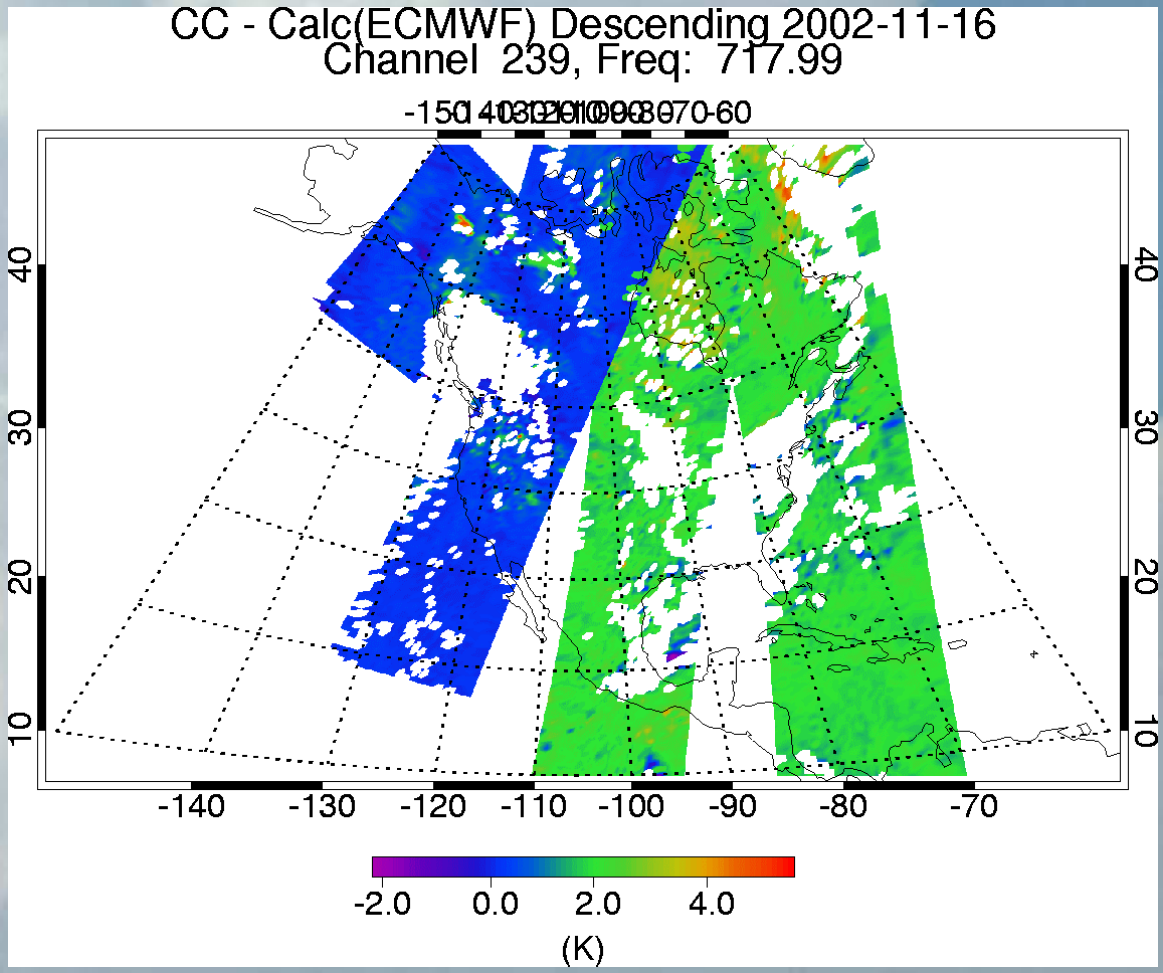


Mapped Calc(ECMWF) - CC Radiances
North America Channel 239

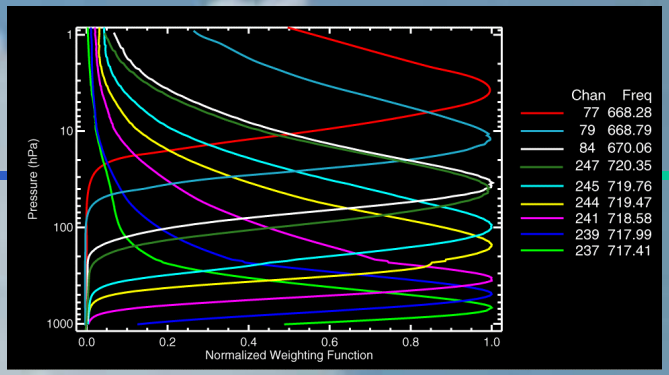
Channel 239 717.99 cm^{-1} 718 hPa

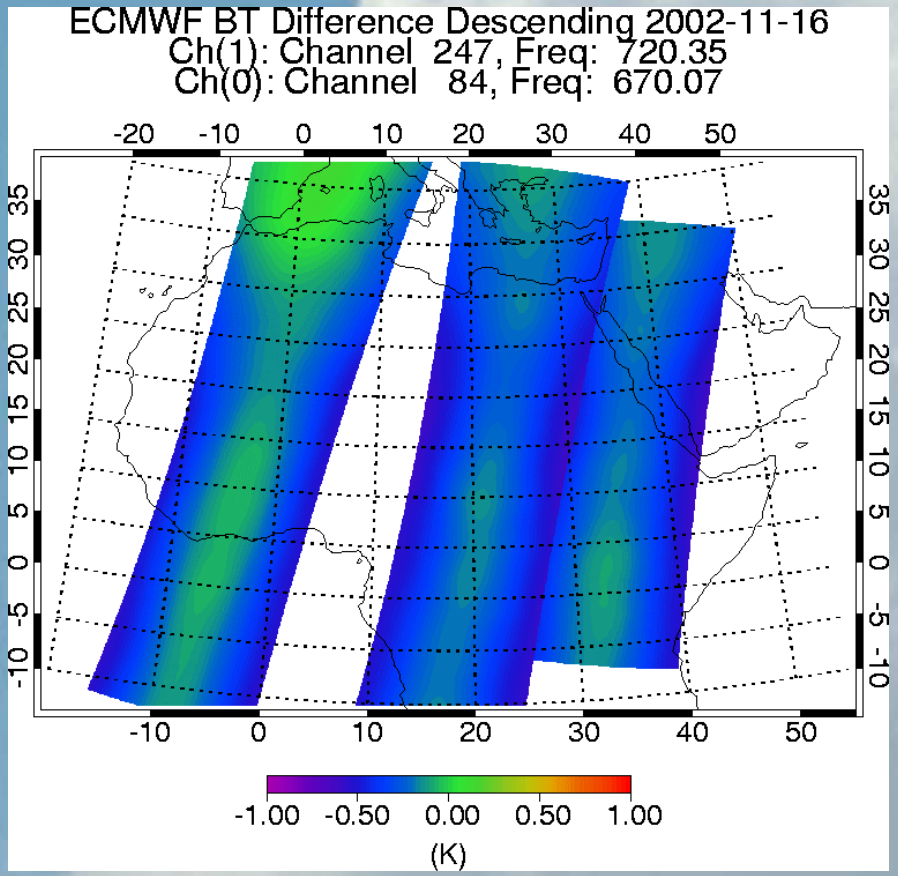


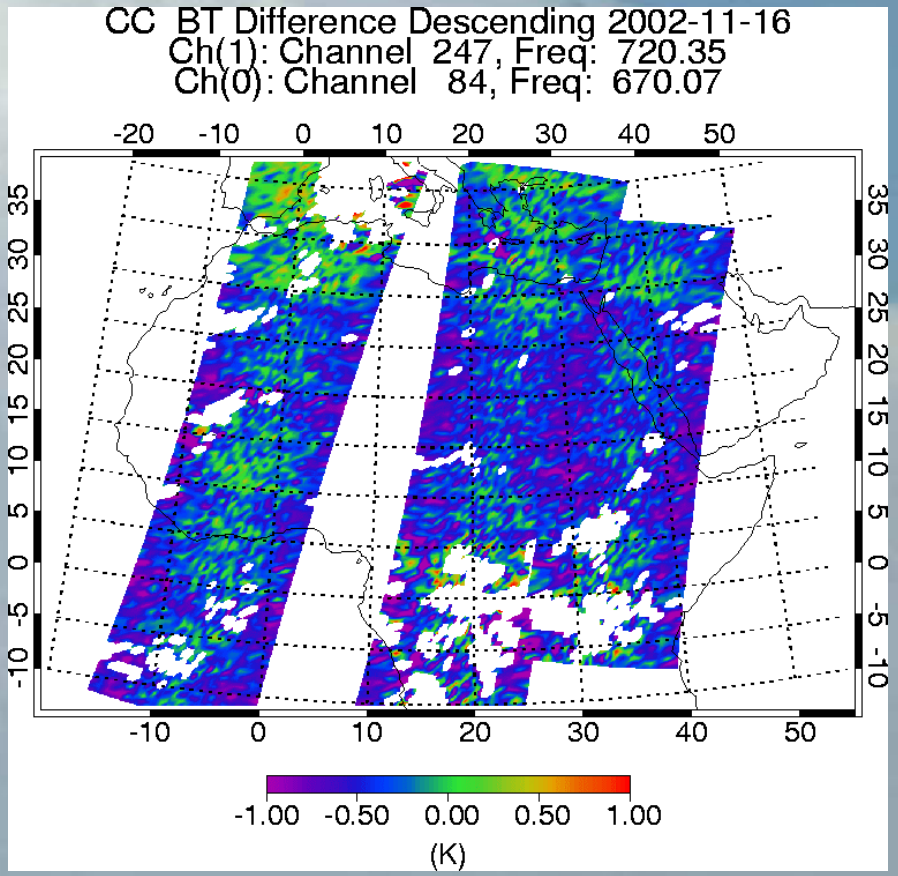




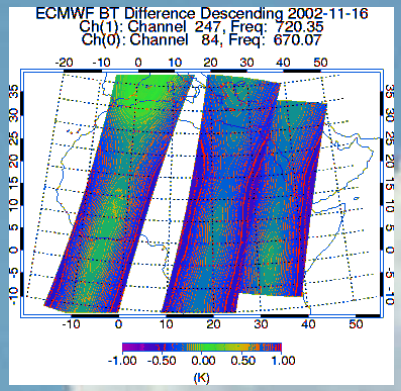
Consistency between Channels

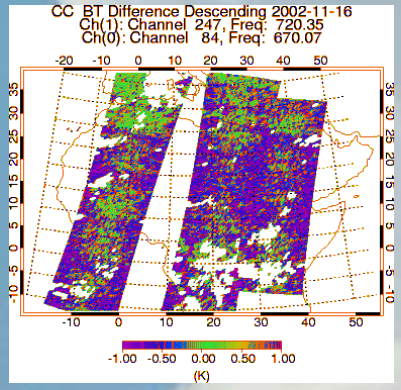


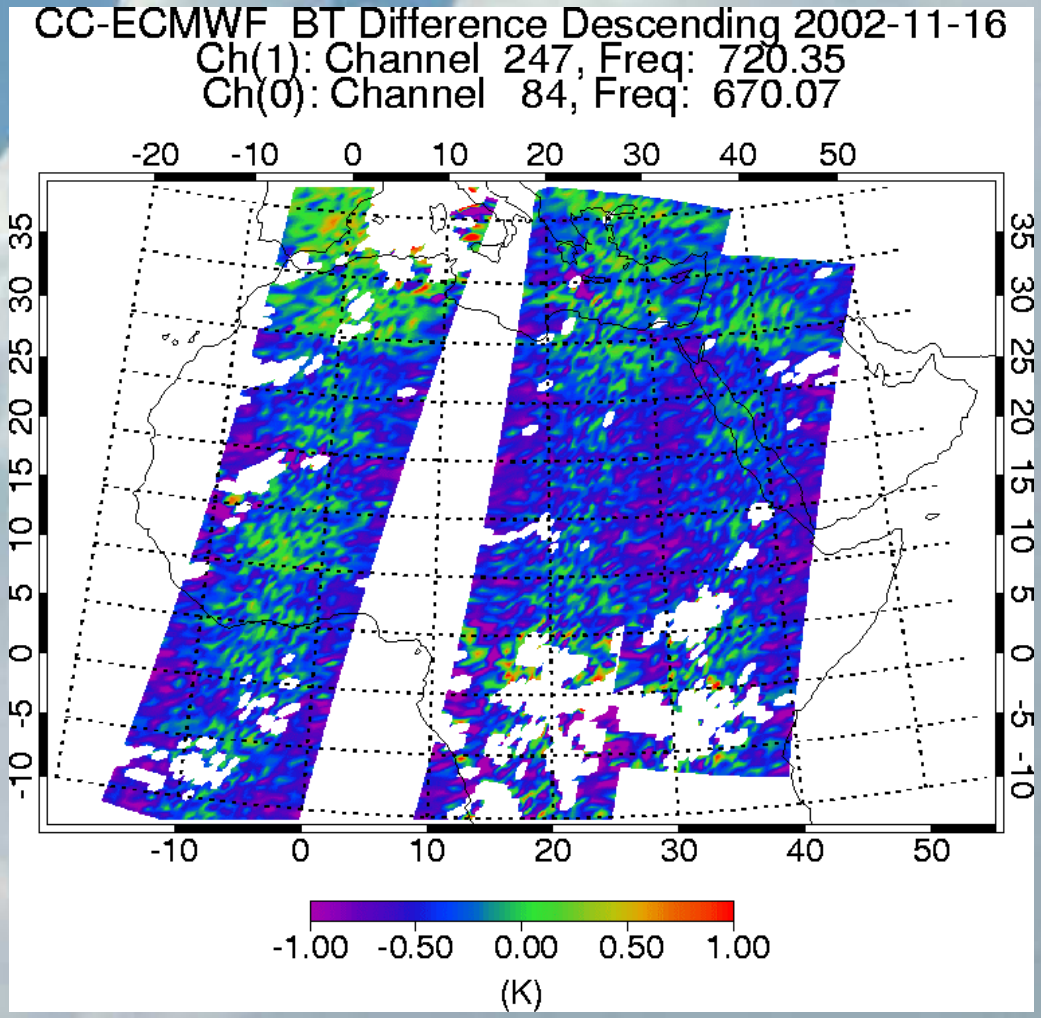


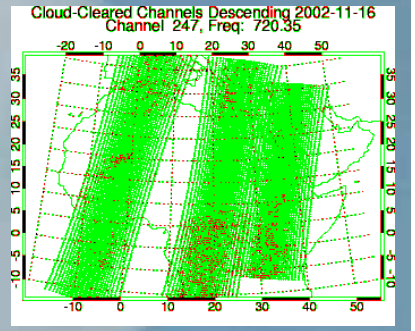


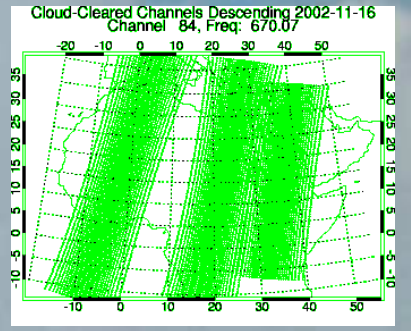
Consistency between Channels











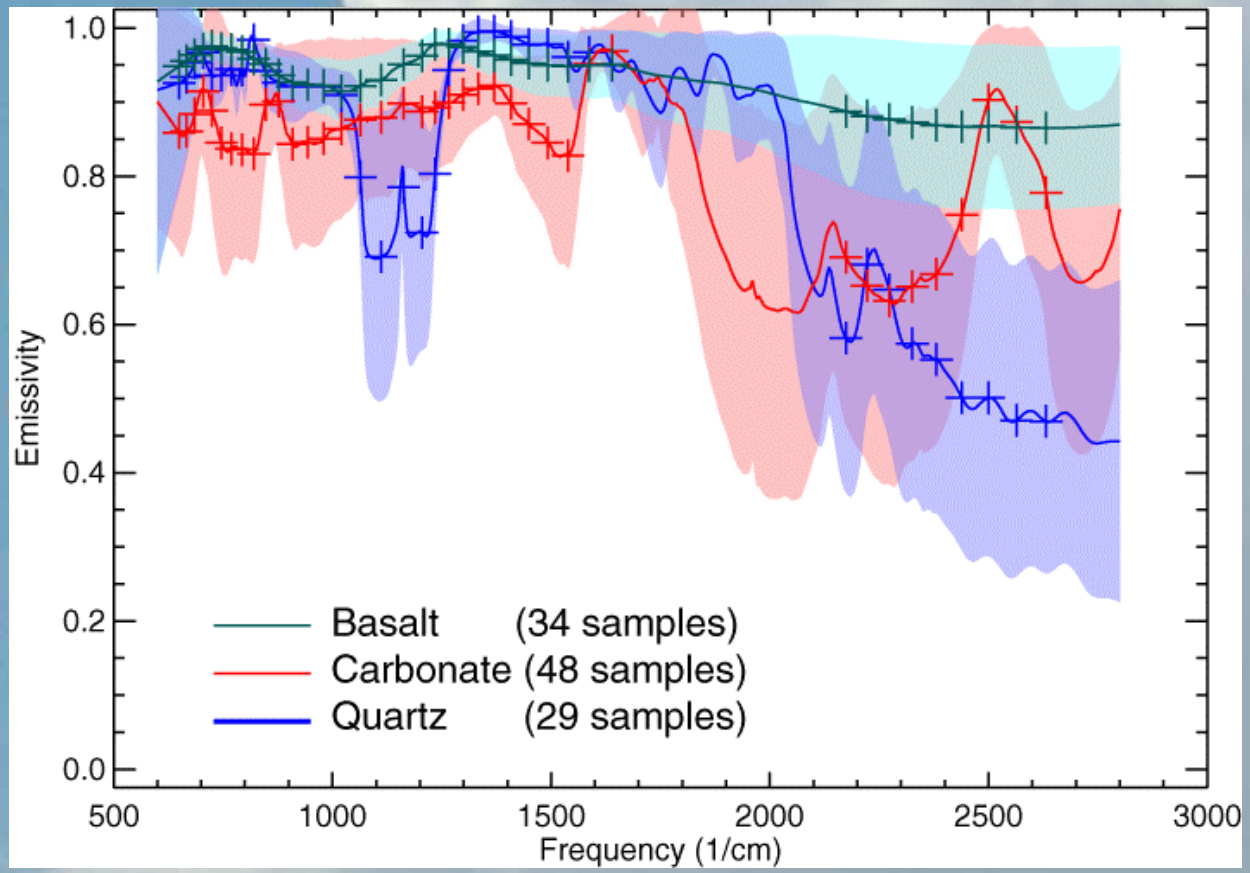
Cloud-Cleared Radiance Summary

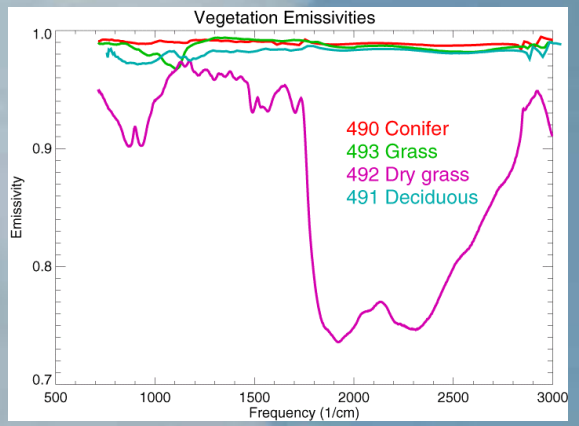
- **CC – ECMWF residuals are dominated by spatially-correlated differences**
  - Scan-dependence
  - State-dependence
- **Stratosphere not as useful as expected**
  - ECMWF temperature errors > 1 K
- **CC error characterize random and systematic errors.**
  - Includes ECMWF errors
- **Possibly at the point where CC – ECMWF residuals have very limited usefulness at this point.**

1. Surface Products

- Comparison of observed and laboratory emissivity spectra
- Emissivity radiometric signatures

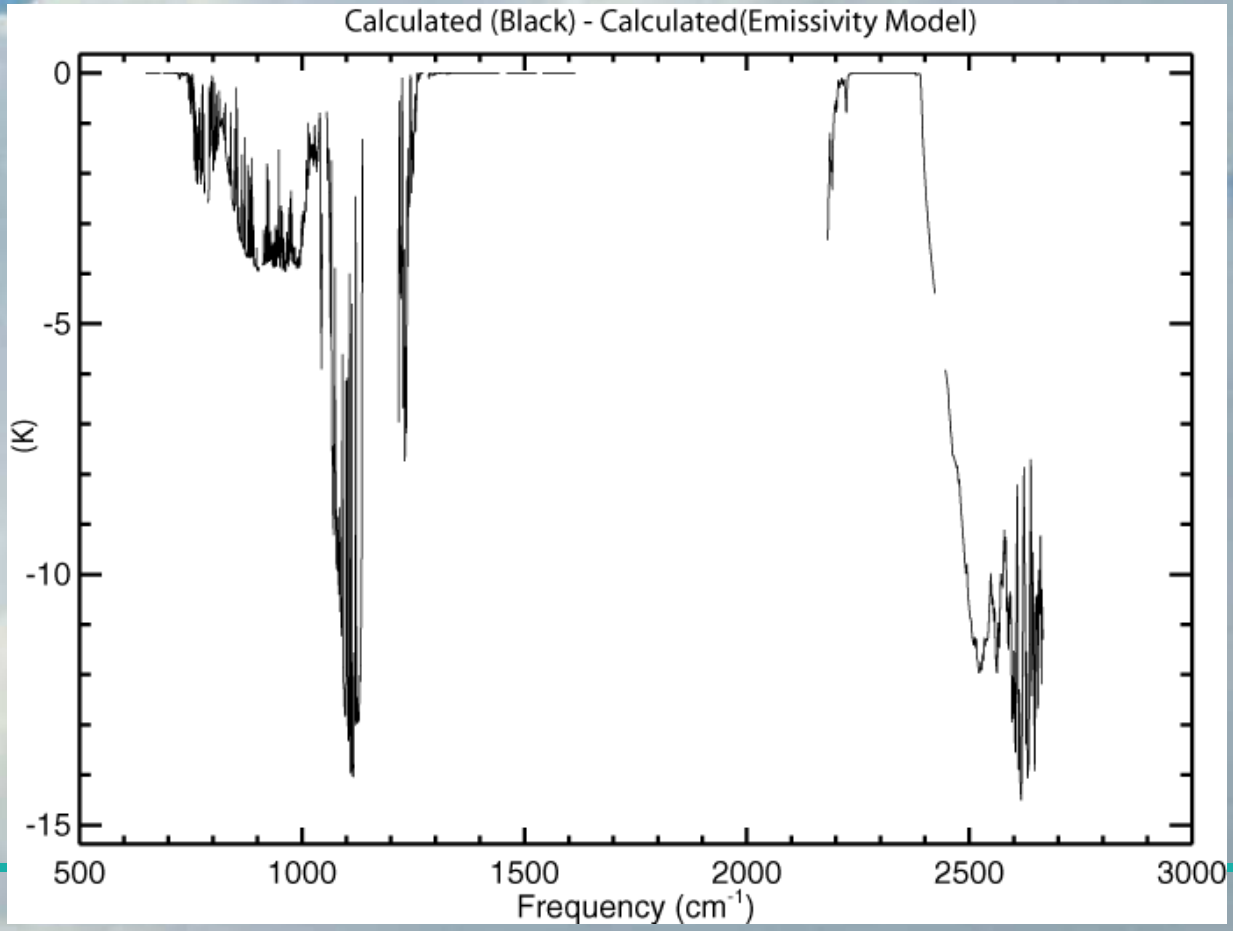
ASTER Emissivity Database



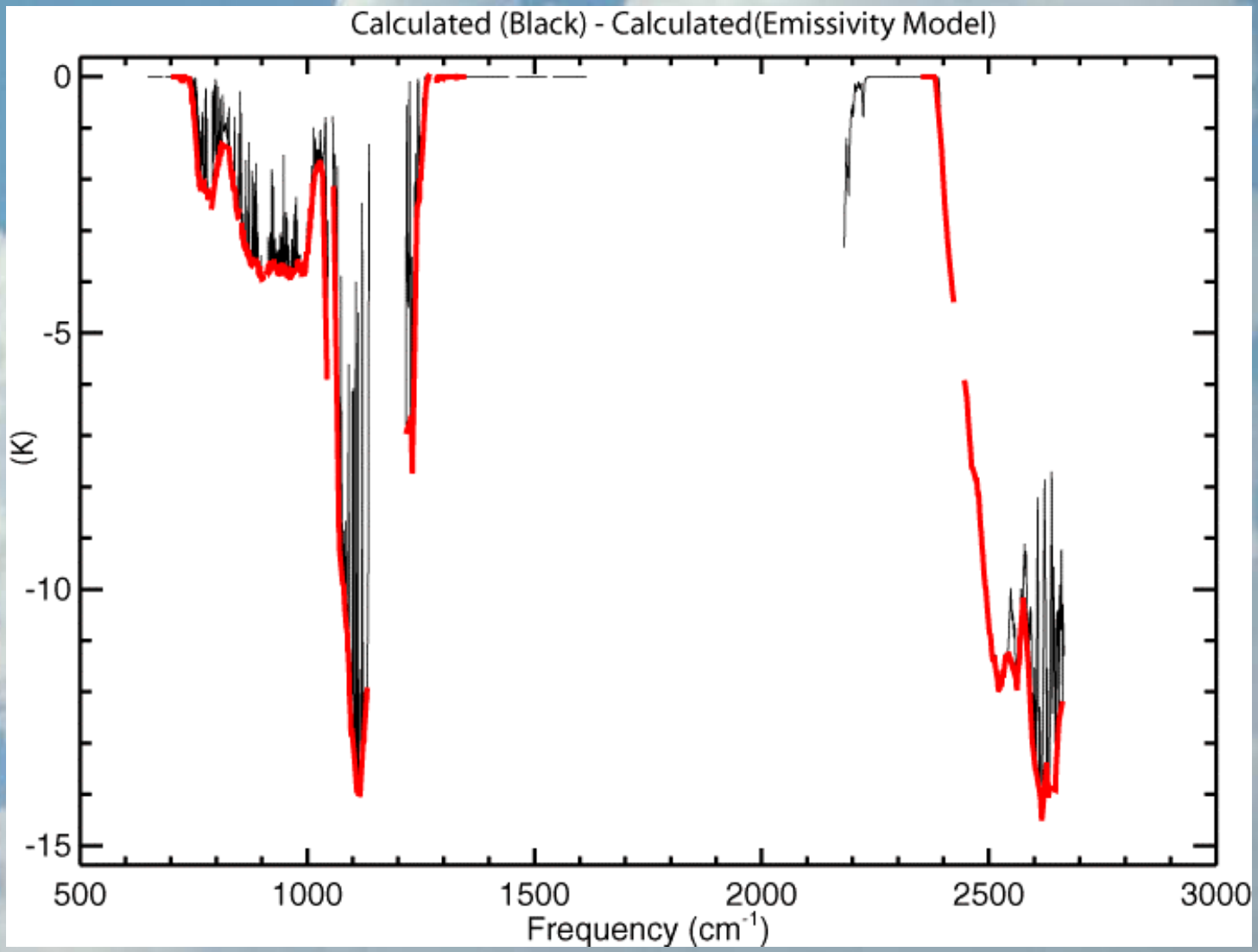


Radiometric Signature of Minerals

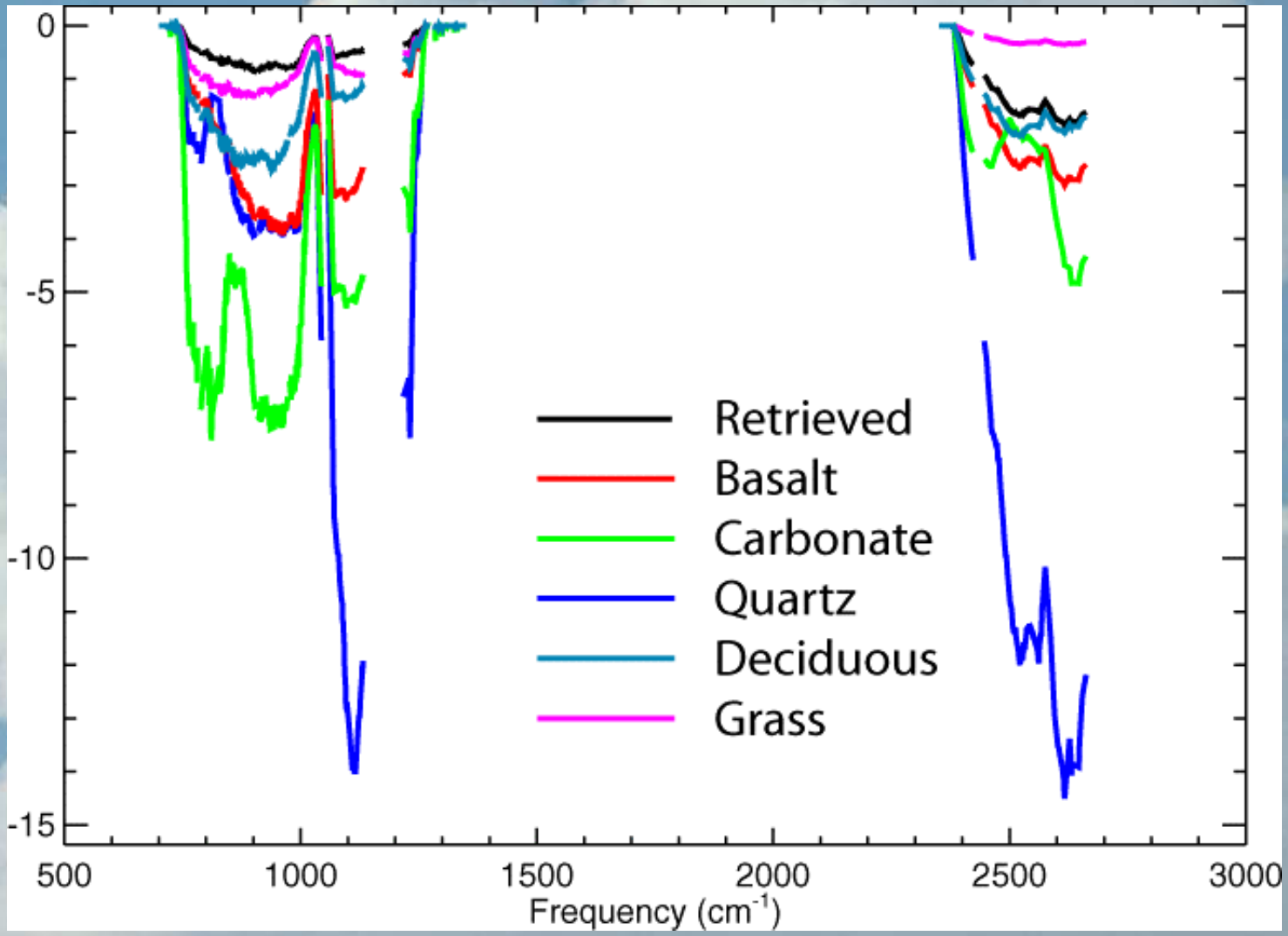
- Retrieved HaGolan atmosphere and skin temperature
- Quartz surface - black surface
- Calc(quartz surface) – Calc(black surface)



Envelope of Radiometric Signature



Model Emissivity Envelopes



Emissivity Spectra

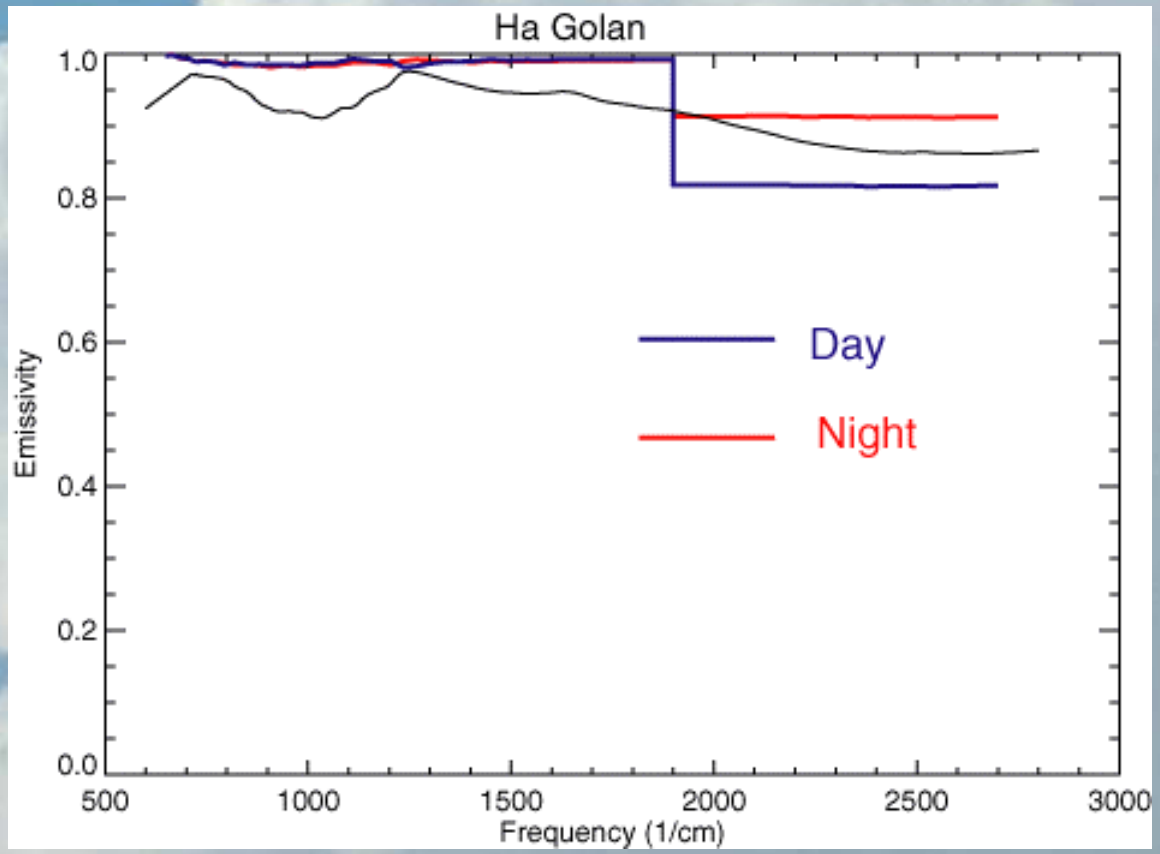
- **Compare retrieved emissivity spectra with laboratory measurements**

- **Locations**

HaGolan Israel/Syria	**Basalts**
HaNegev, Israel	**Carbonates**
Egypt 1	**Quartz sands**
Salonga NP, Zaire	**Tropical forest**

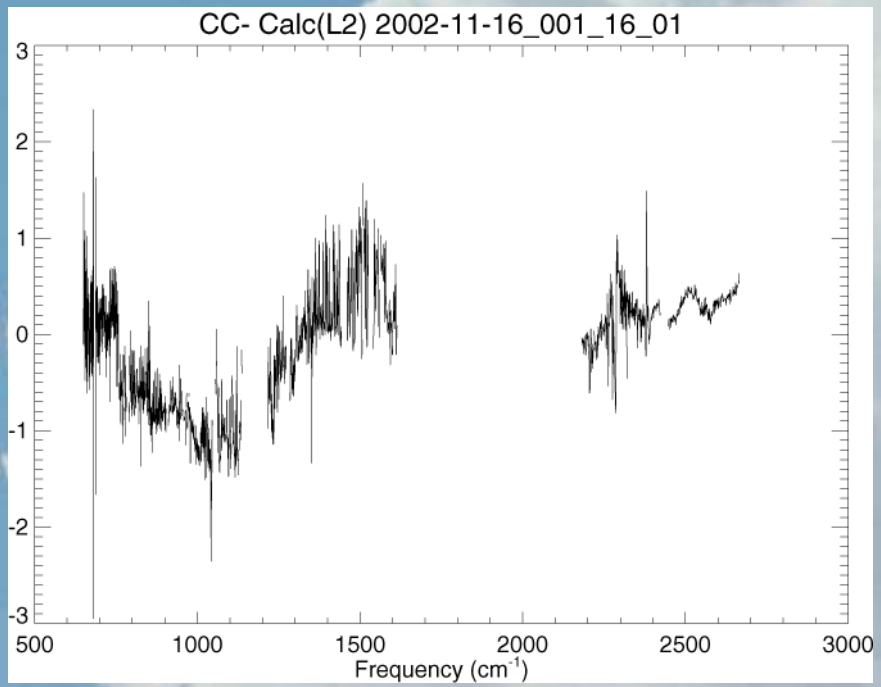
Ha Golan (Israel/Syria)

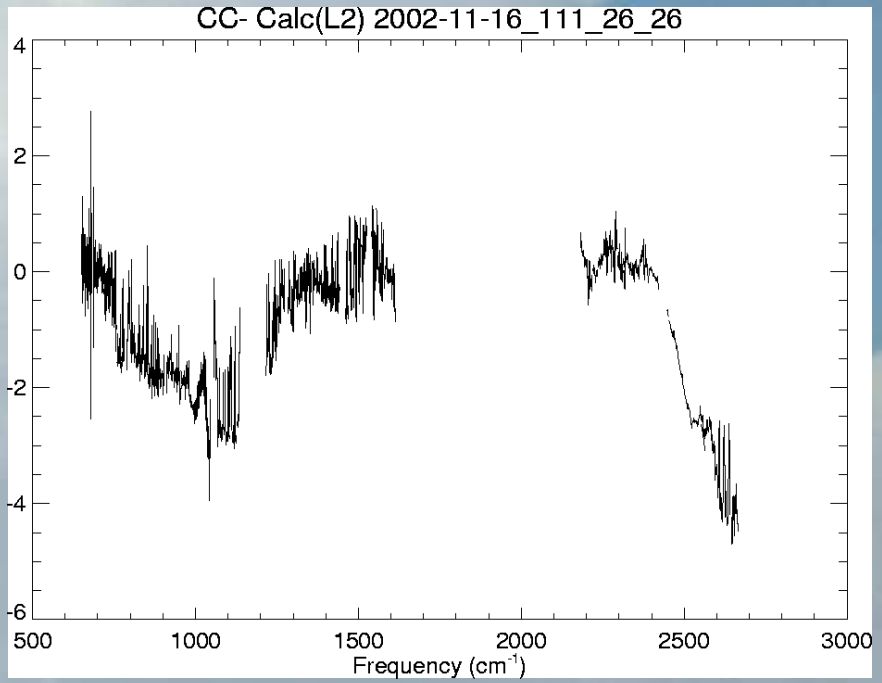
- **33.04°N, 36.04°E**
- **Rift flood basalts**



Ha Golan (Israel/Syria) Radiance Residuals

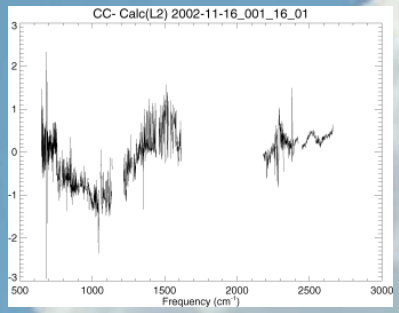
- **CC – Calculated using retrieved states**

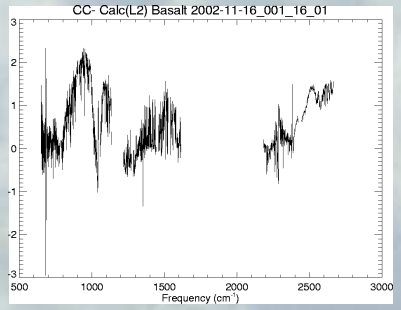


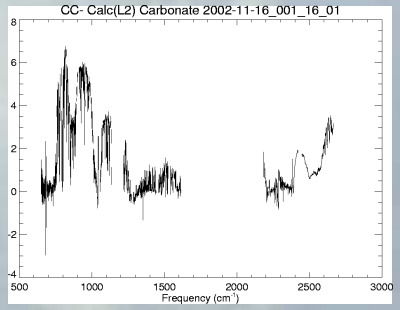


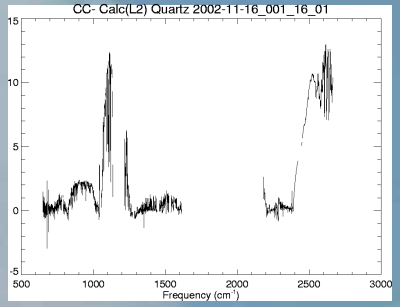
Ha Golan (Israel/Syria) Radiance Residuals

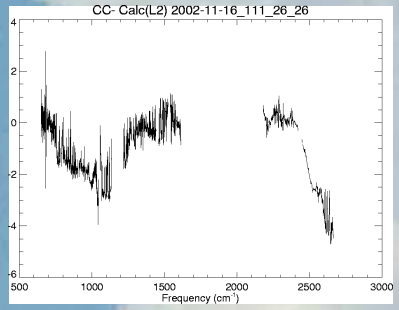
- **Calculated using emissivity database**

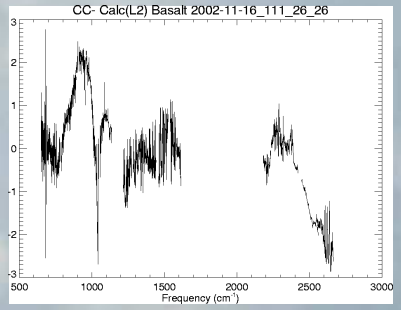


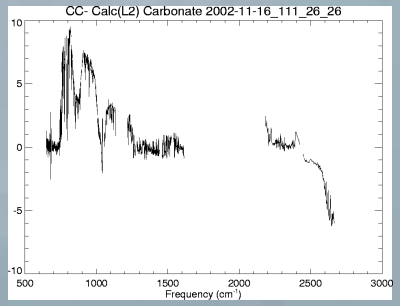


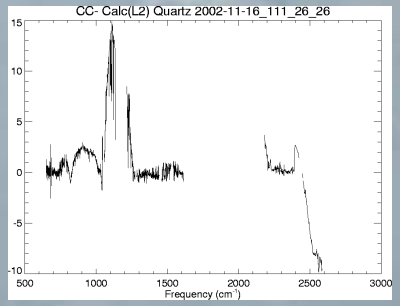






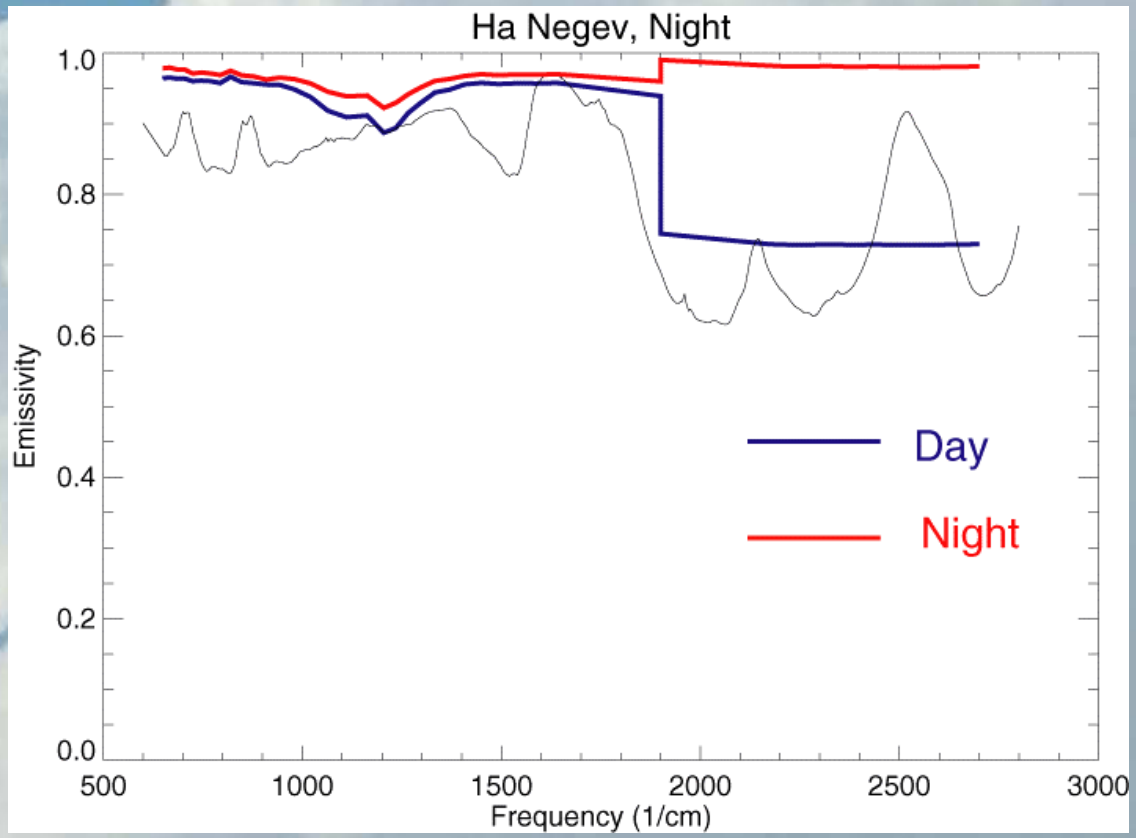






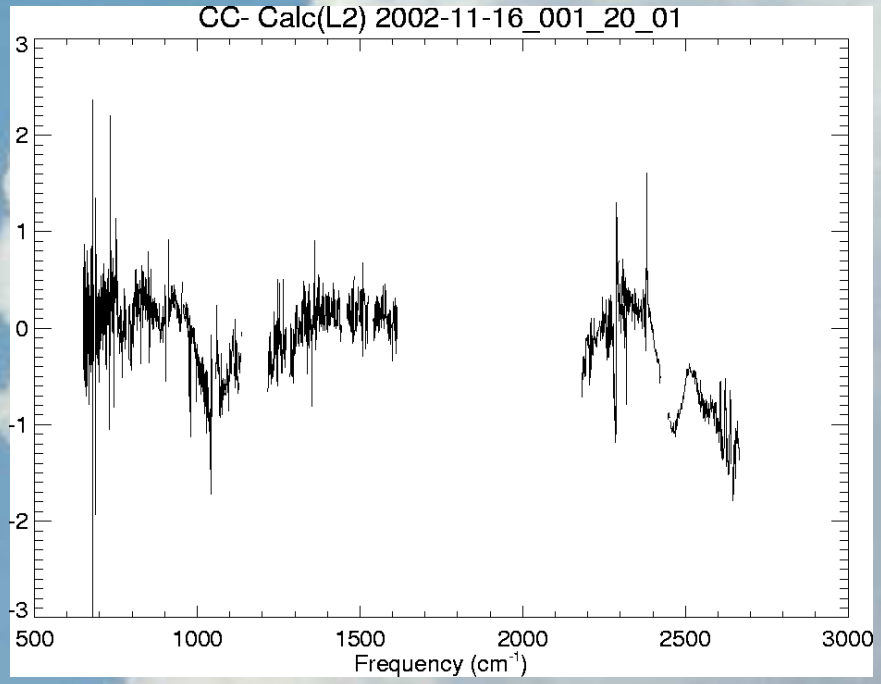
Ha Negev (Israel/Syria)

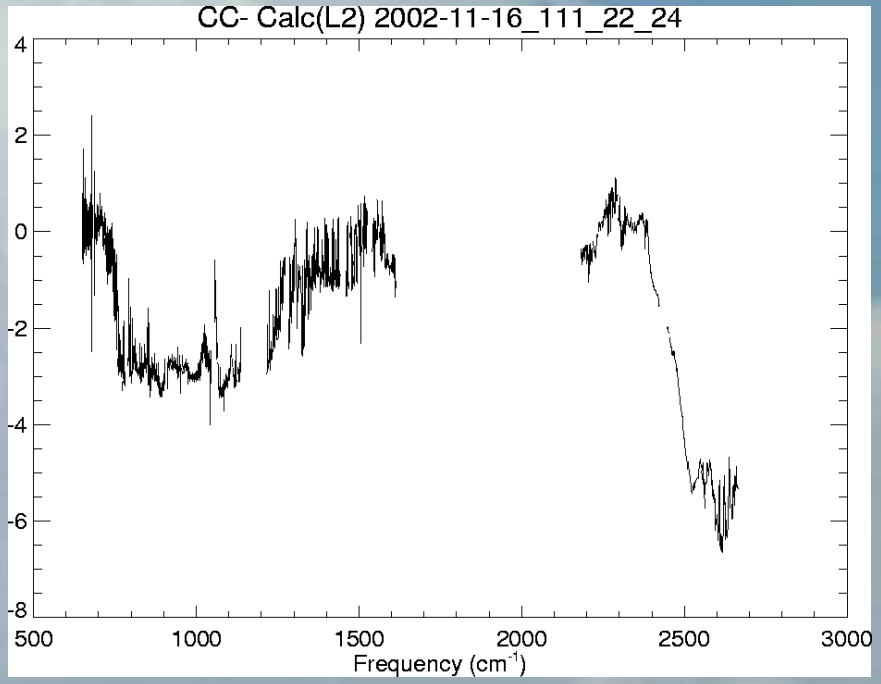
- 30.93°N, 34.77°E
- Carbonates



Ha Negev Radiance Residuals

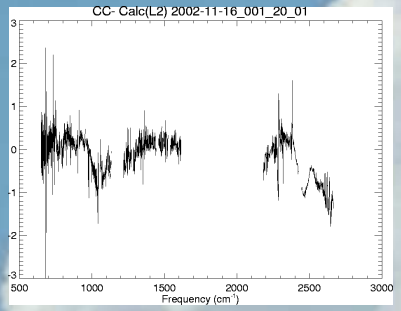
- **CC – Calculated using retrieved states**

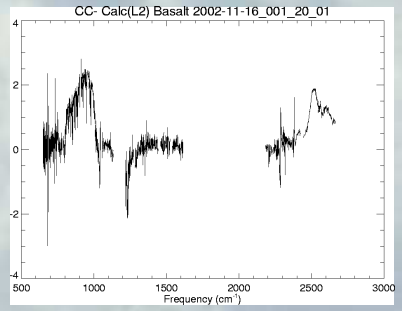


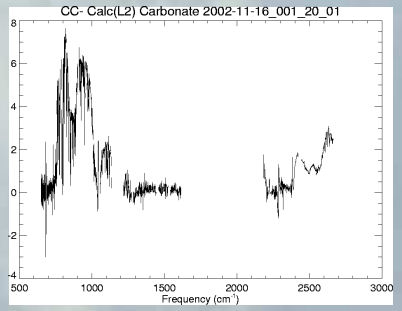


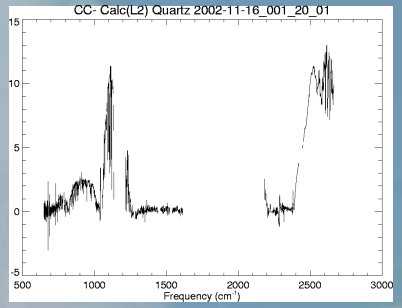
Ha Negev Radiance Residuals

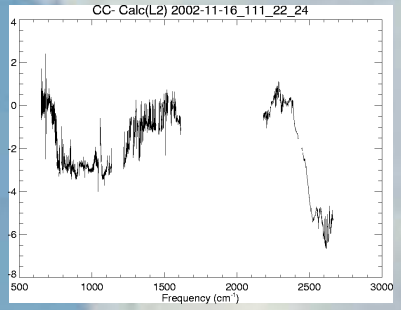
- **Calculated using emissivity database**

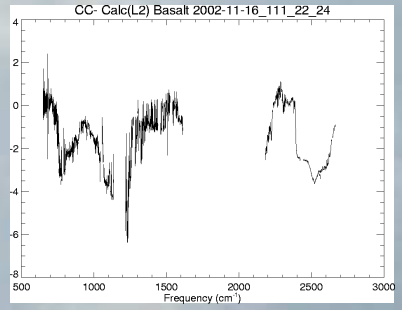


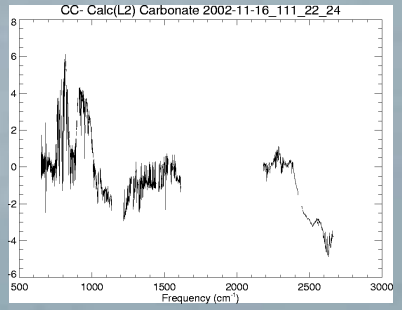


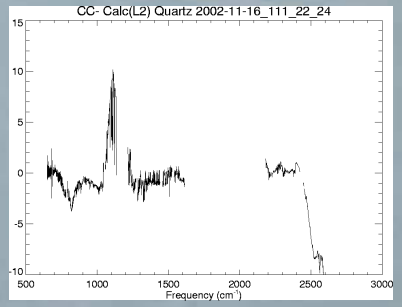






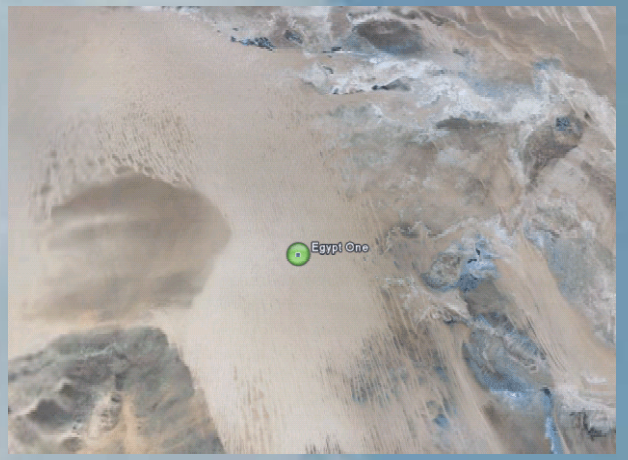


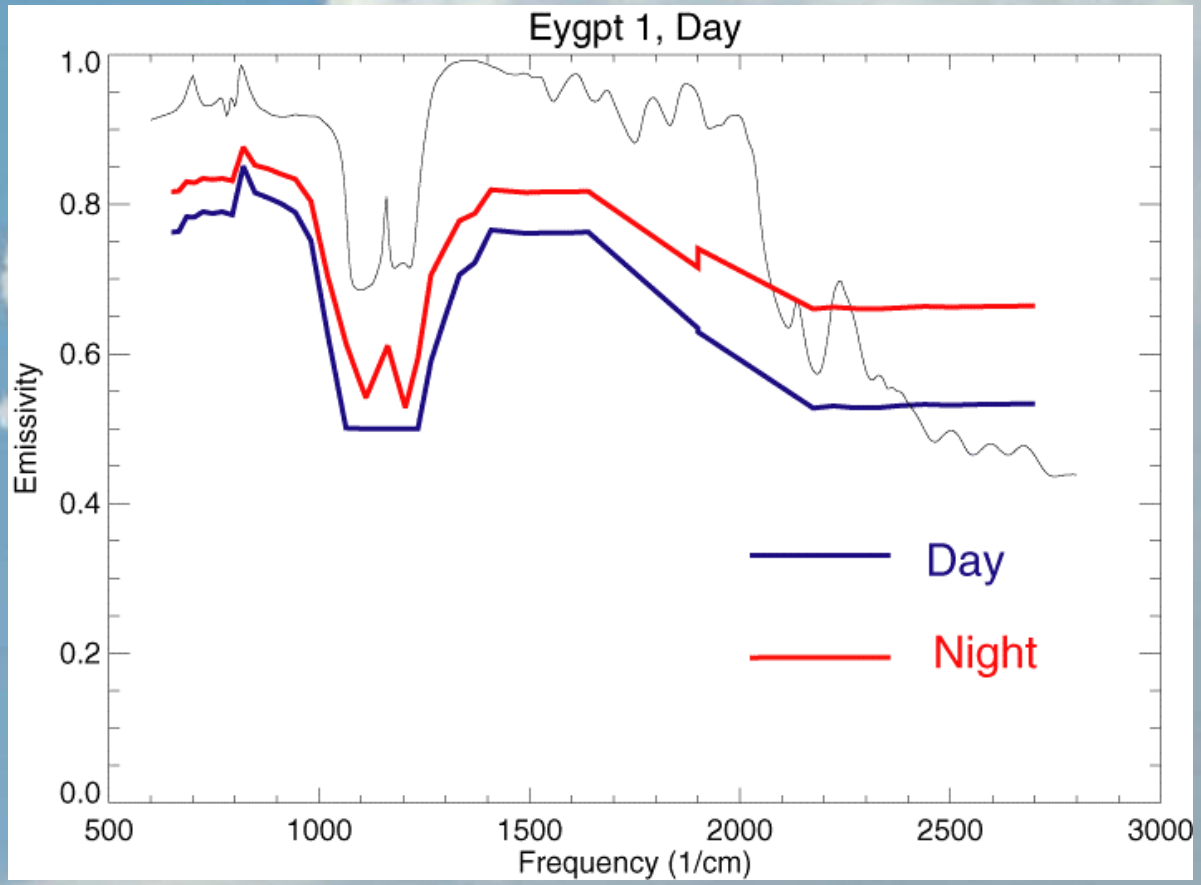




Egypt One

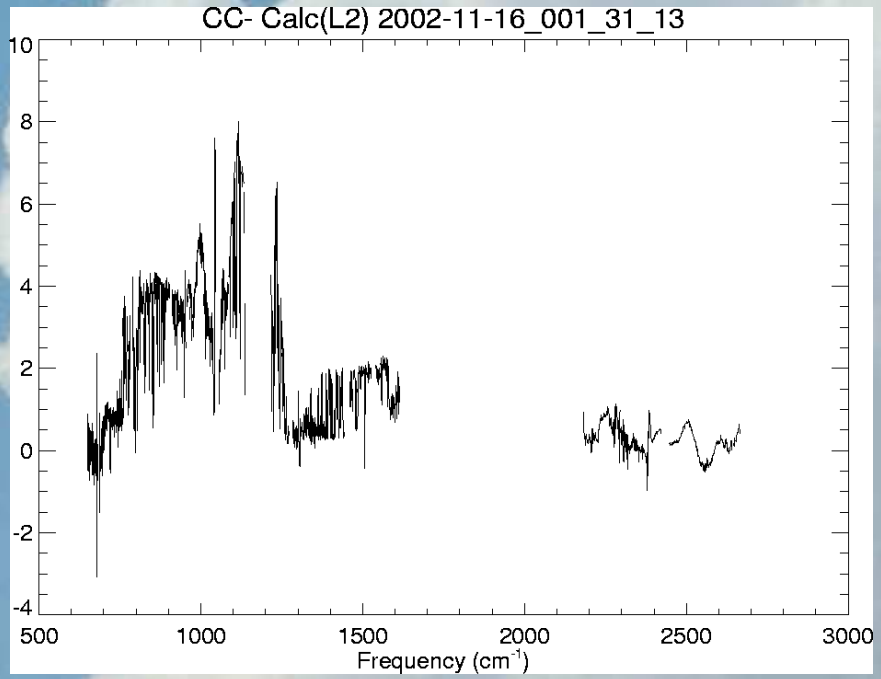
- 27°7’ N, 26°6’ E
- Quartz Sands

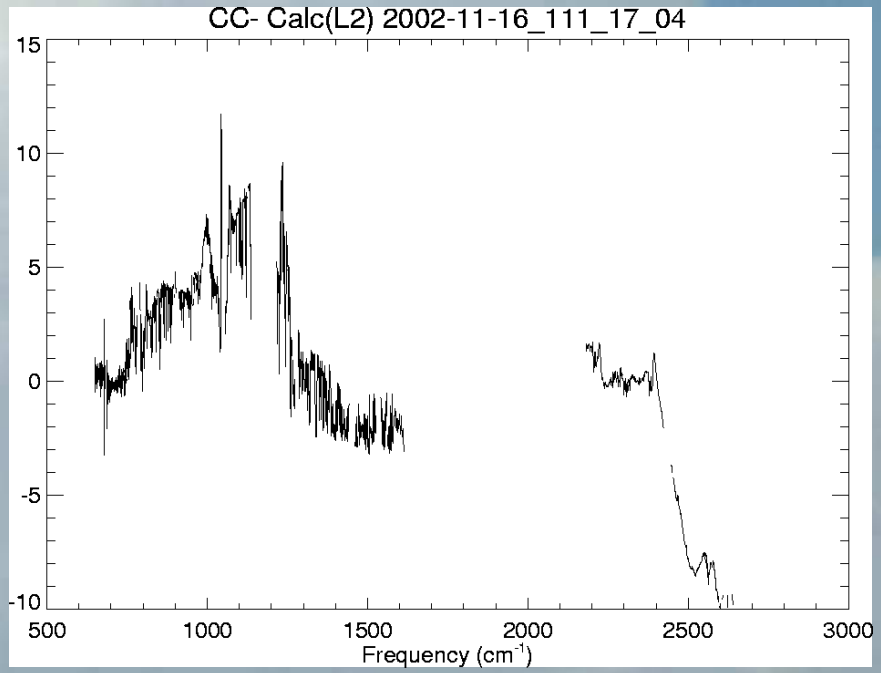




Egypt One Radiance Residuals

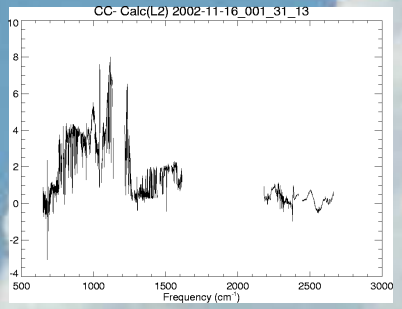
- **CC – Calculated using retrieved states**

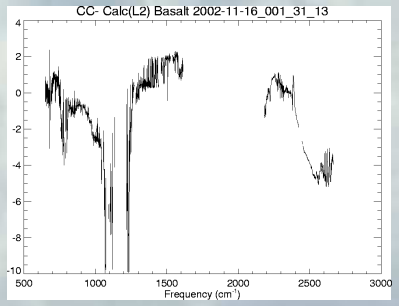


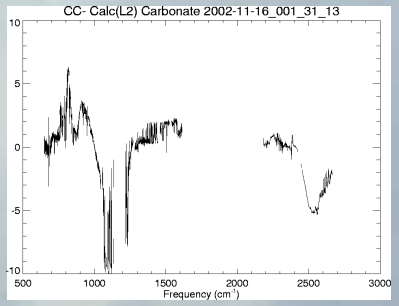


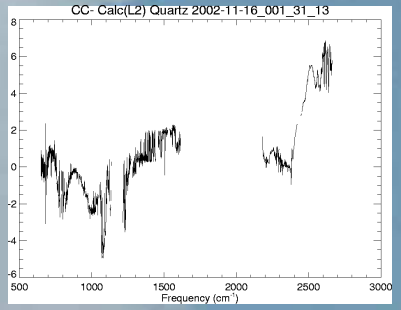
Egypt One Radiance Residuals

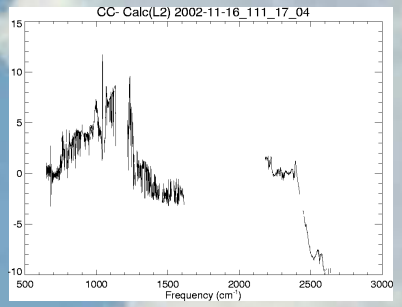
- **Calculated using emissivity database**

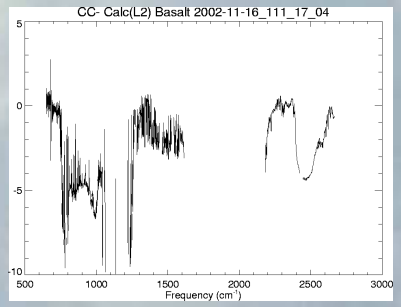


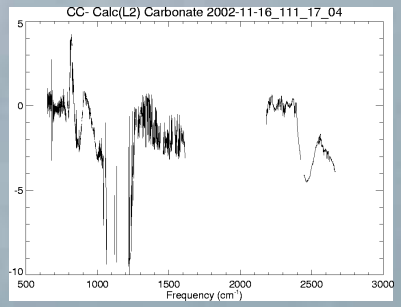


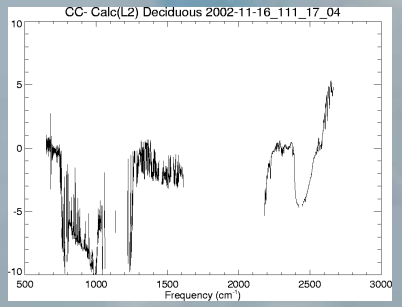






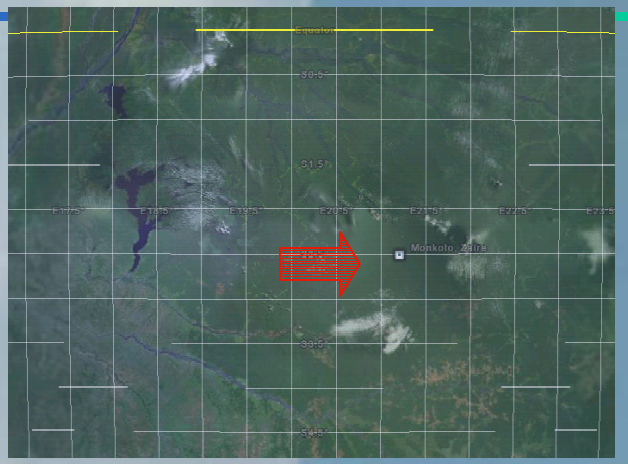


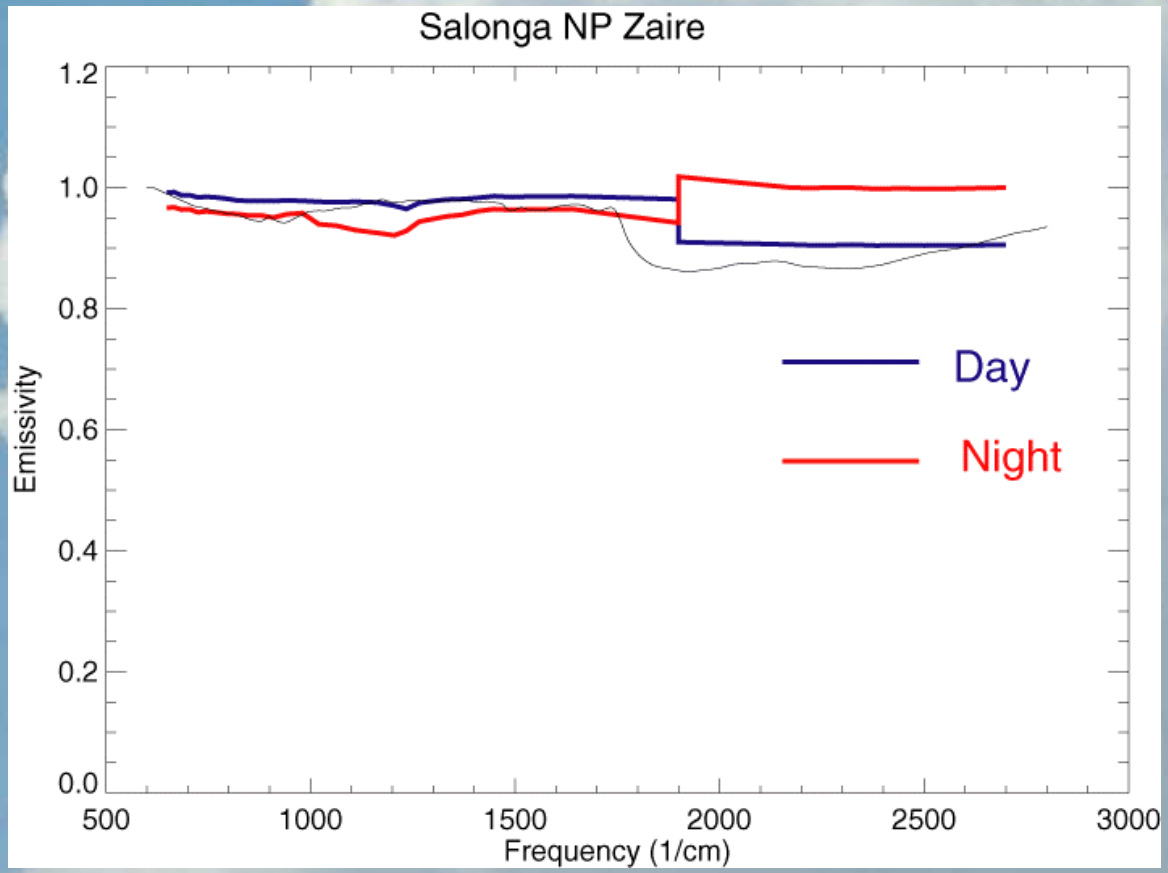




Salonga National Park, Zaire

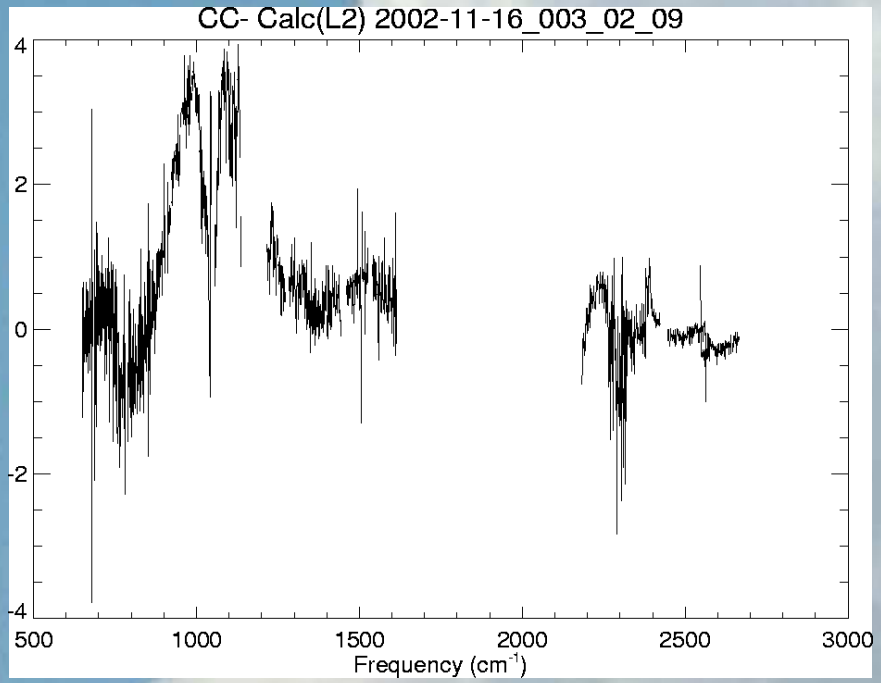
- 2°27’ S, 21°15’ E
- Vegetated tropical rain forest

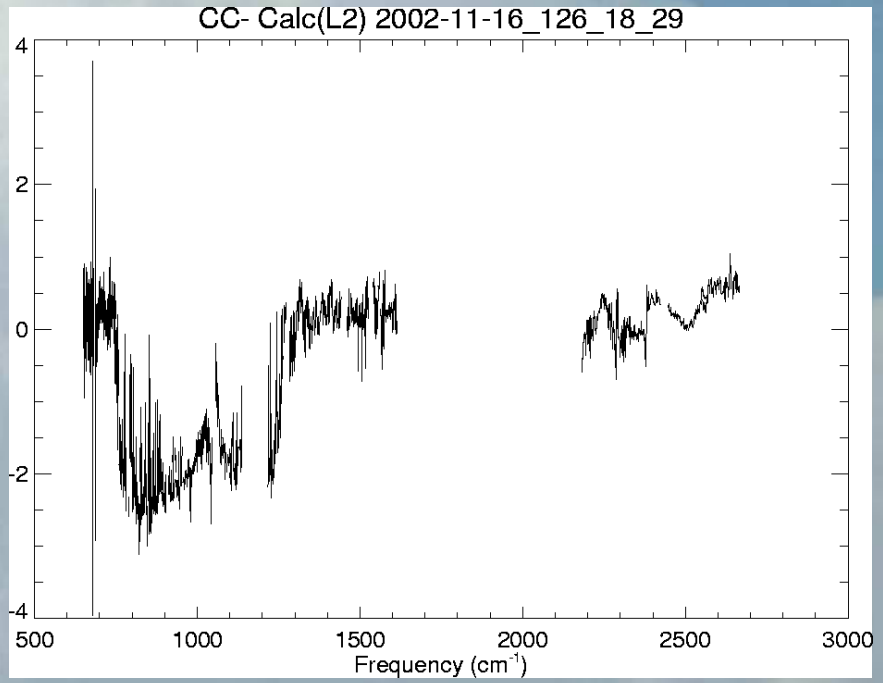




Salonga National Park, Zaire

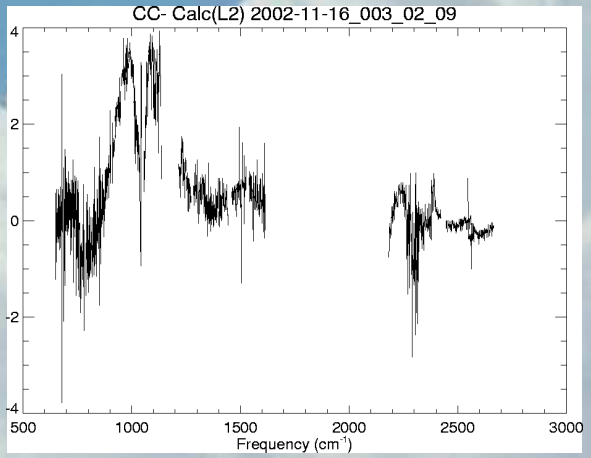
- **CC – Calculated using retrieved states**

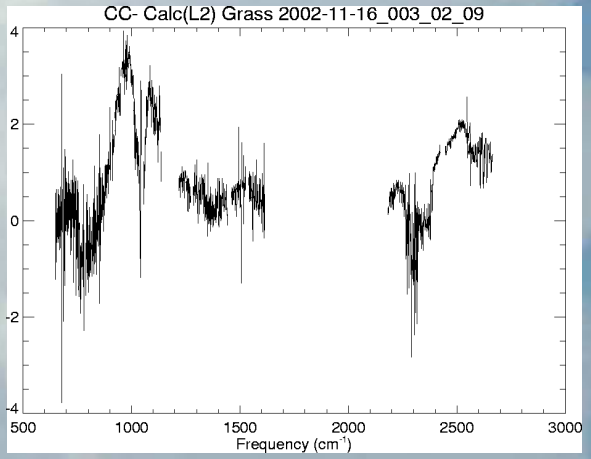


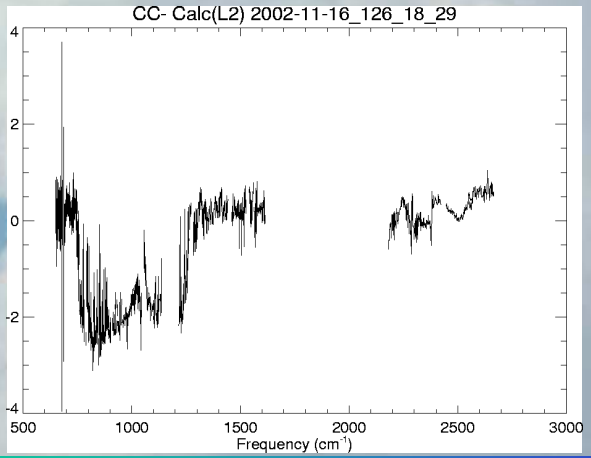


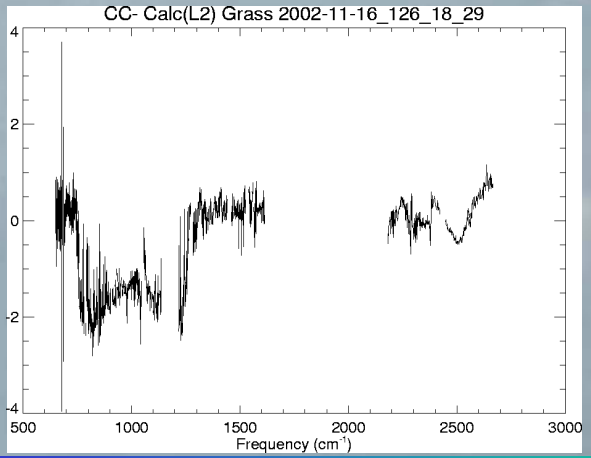
Salonga National Park, Zaire

- **Calculated using emissivity database**









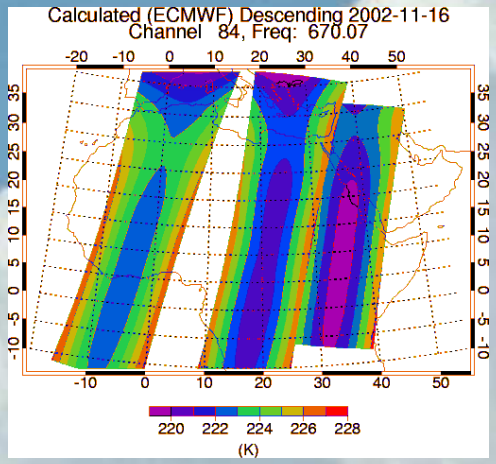
Emissivity Summary

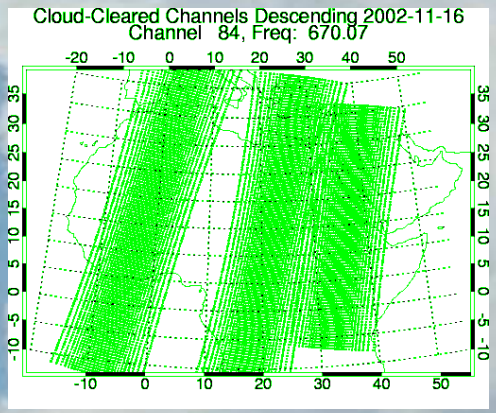
- **Significant improvements in long-wave emissivty**
  - Attributed to regression
- **Strong Day-night differences in short-wave emissivity**
  - Attributed to short-wave only skin temperature retrieval
- **Skin temperatures have day night differences**

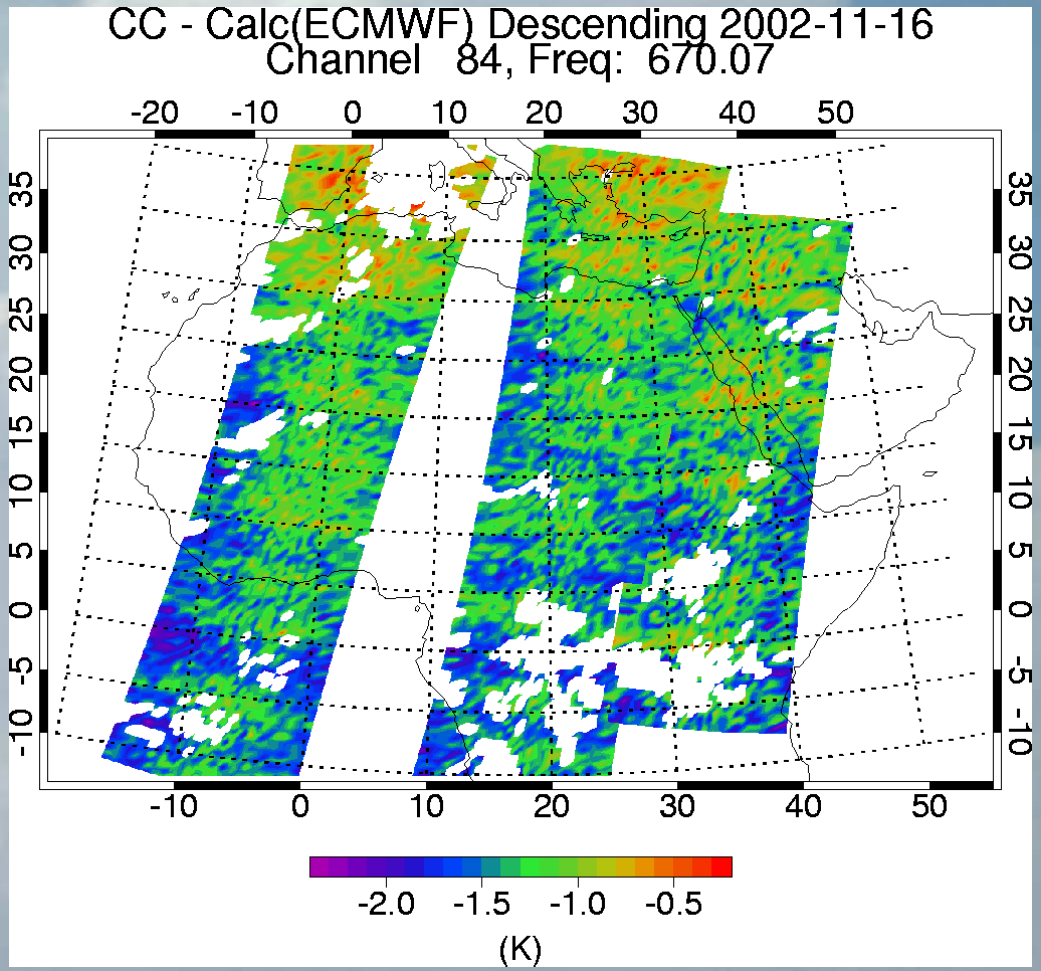

BACKUP SLIDES

Channel 84 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 84, 670.35 cm^{-1} , 35 hPa**

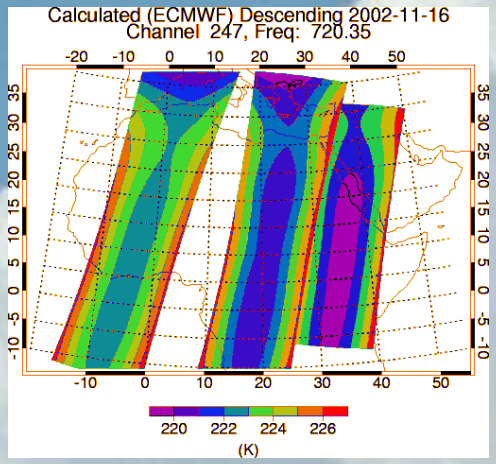


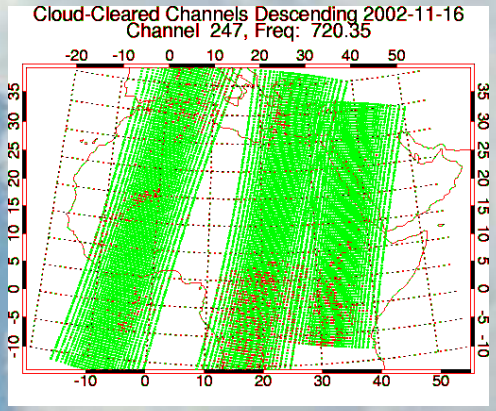


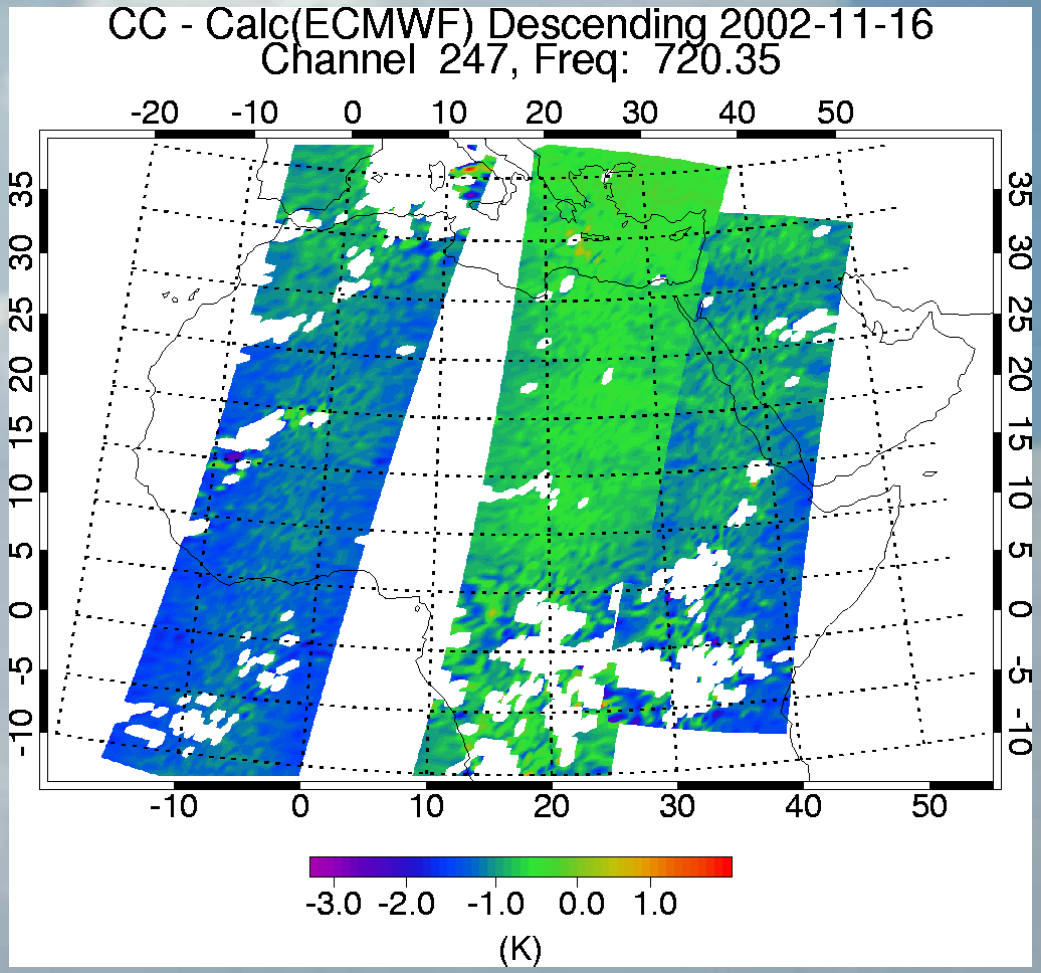


Channel 247 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 247 720.35 cm^{-1} , 40 hPa**

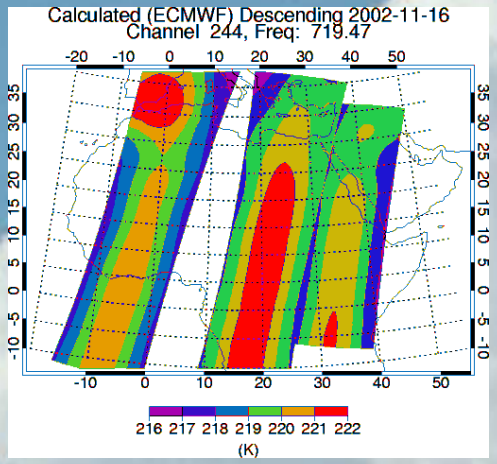


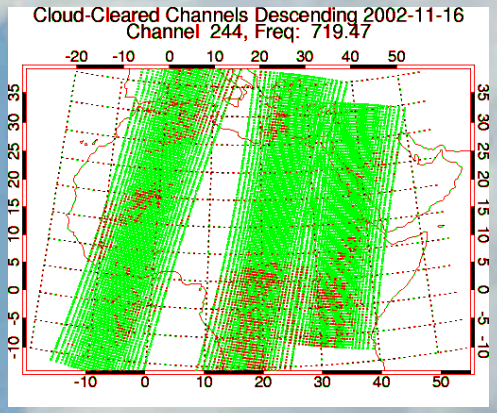


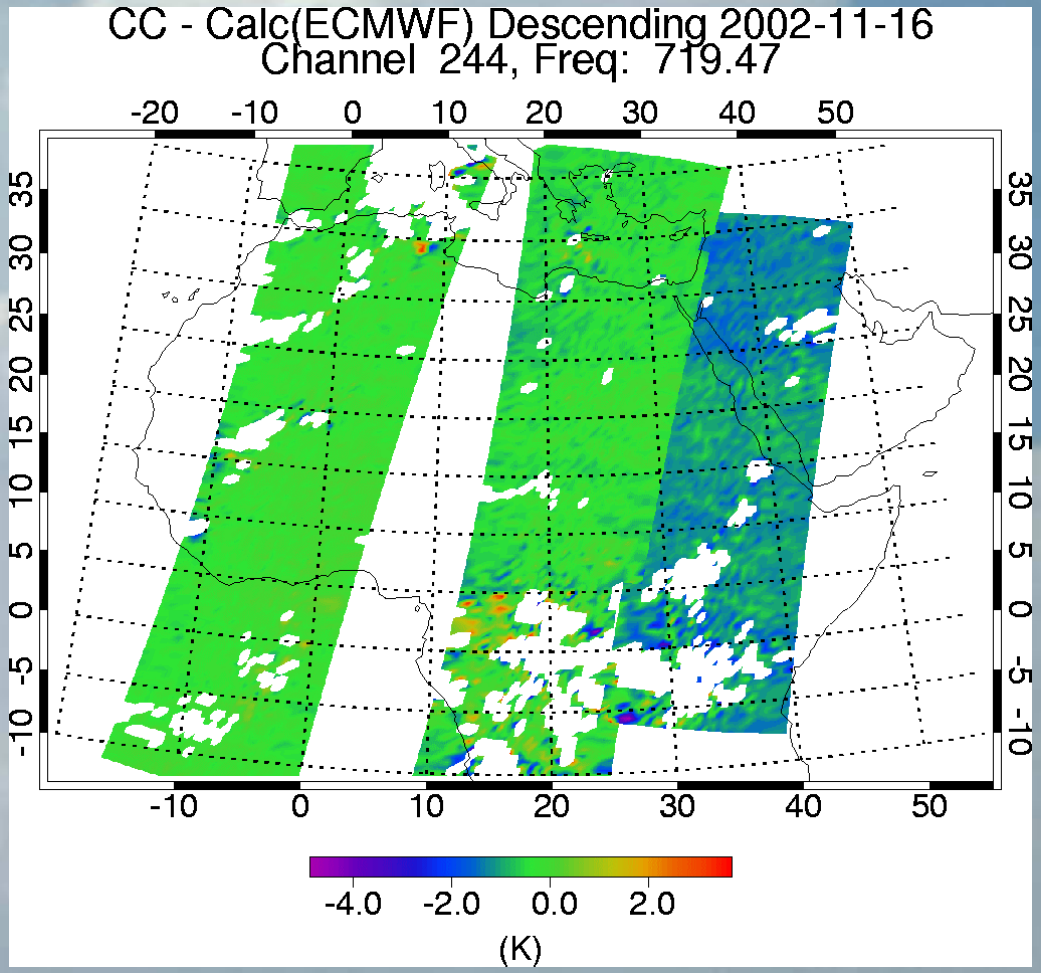


Channel 244 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 244, 719.47 cm^{-1} , 150 hPa**

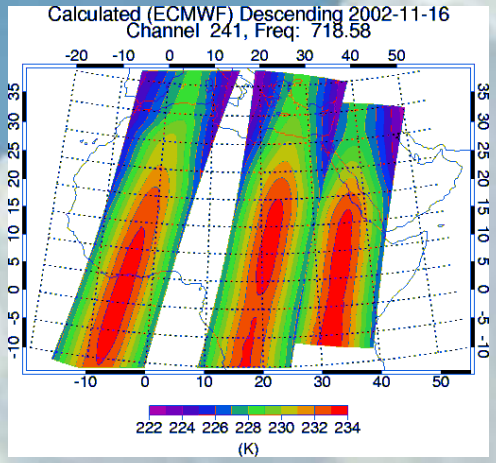


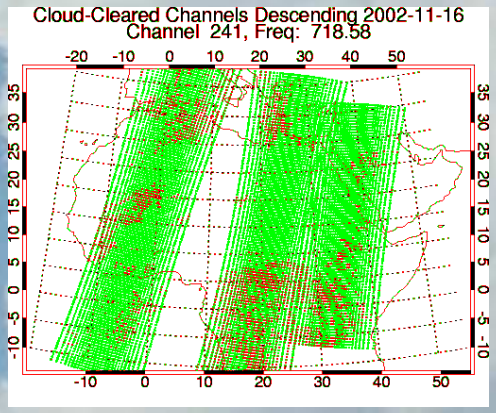


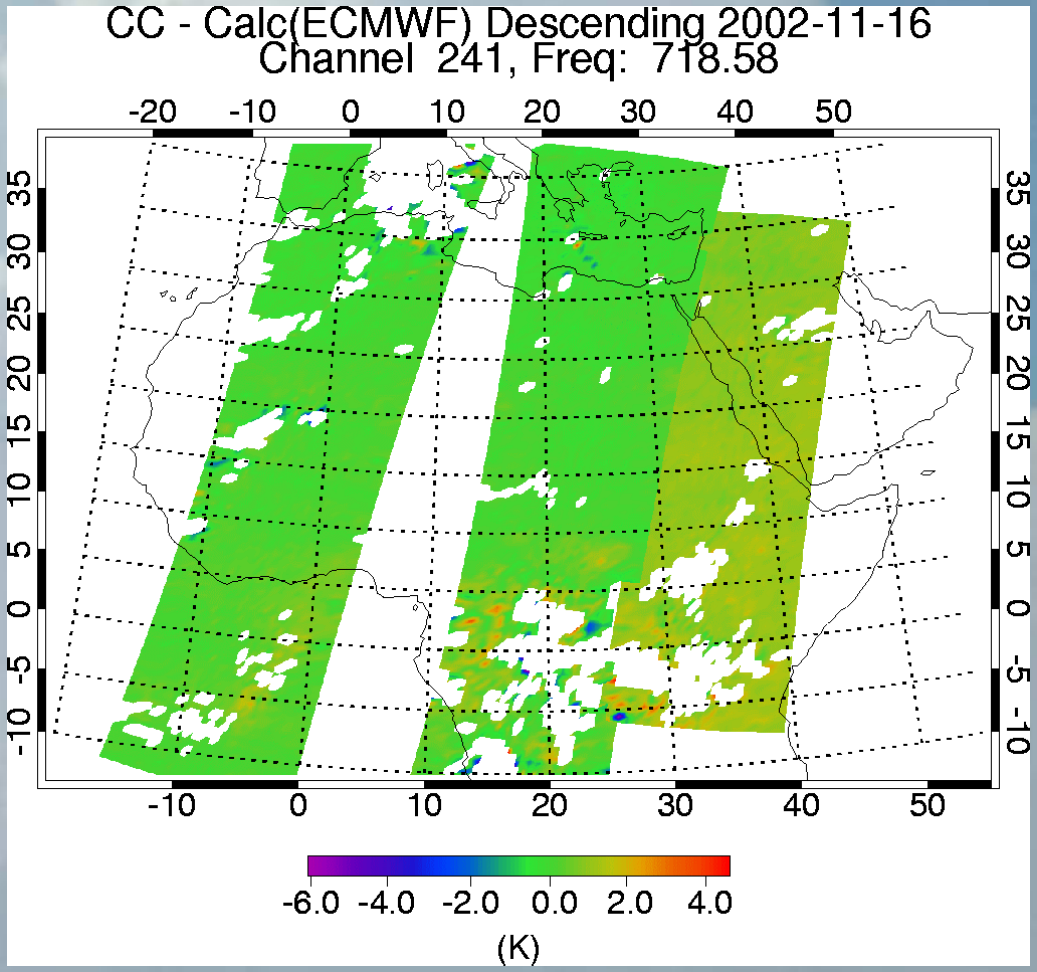


Channel 241 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 241, 718.58 cm^{-1} , 340 hPa**

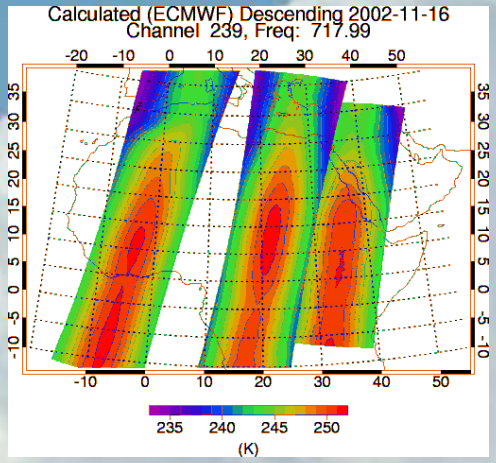


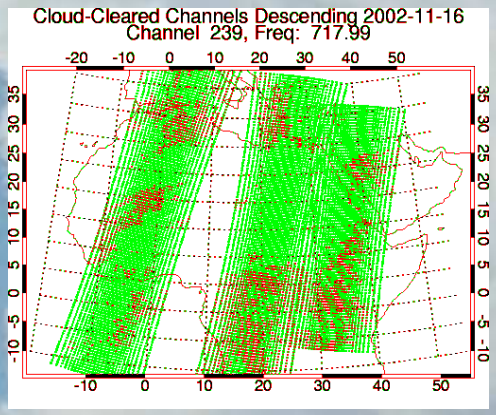


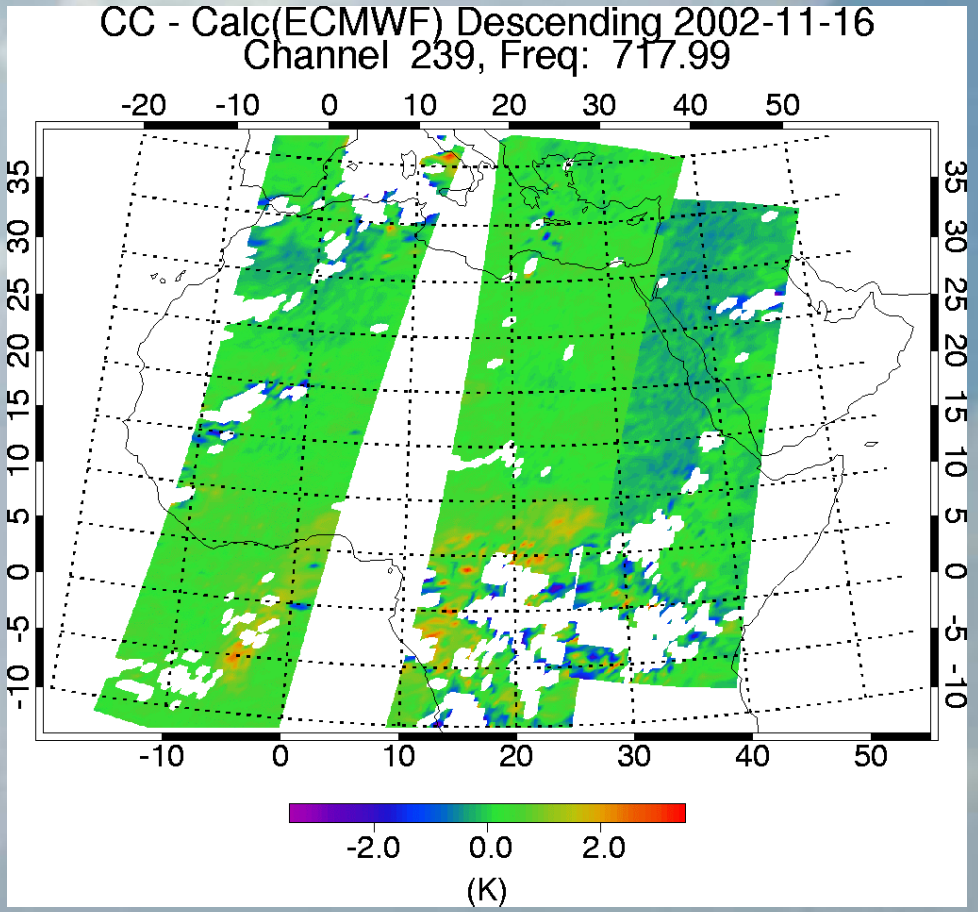


Channel 239 North Africa
Mapped CC – Calc (ECMWF) Differences

- **Channel 239, 717.99 cm^{-1} , 490 hPa**

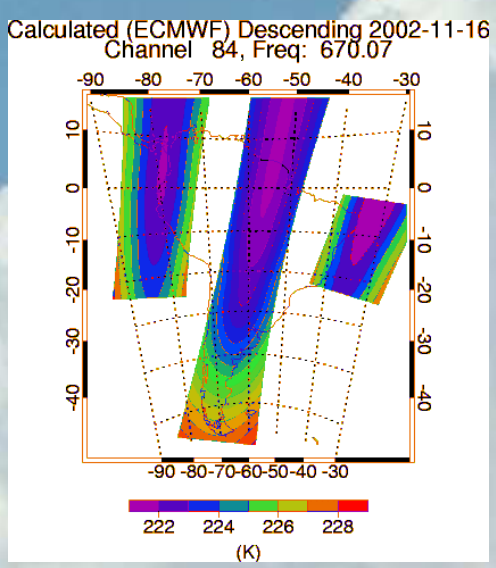


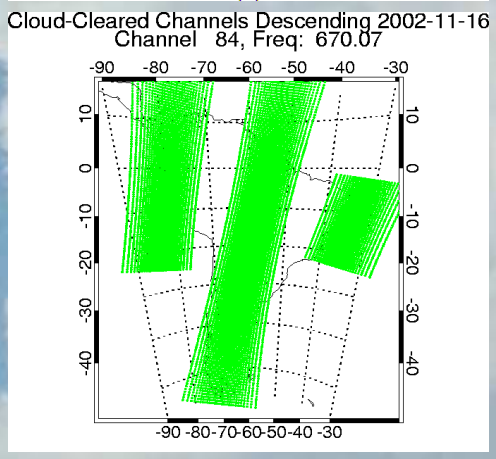


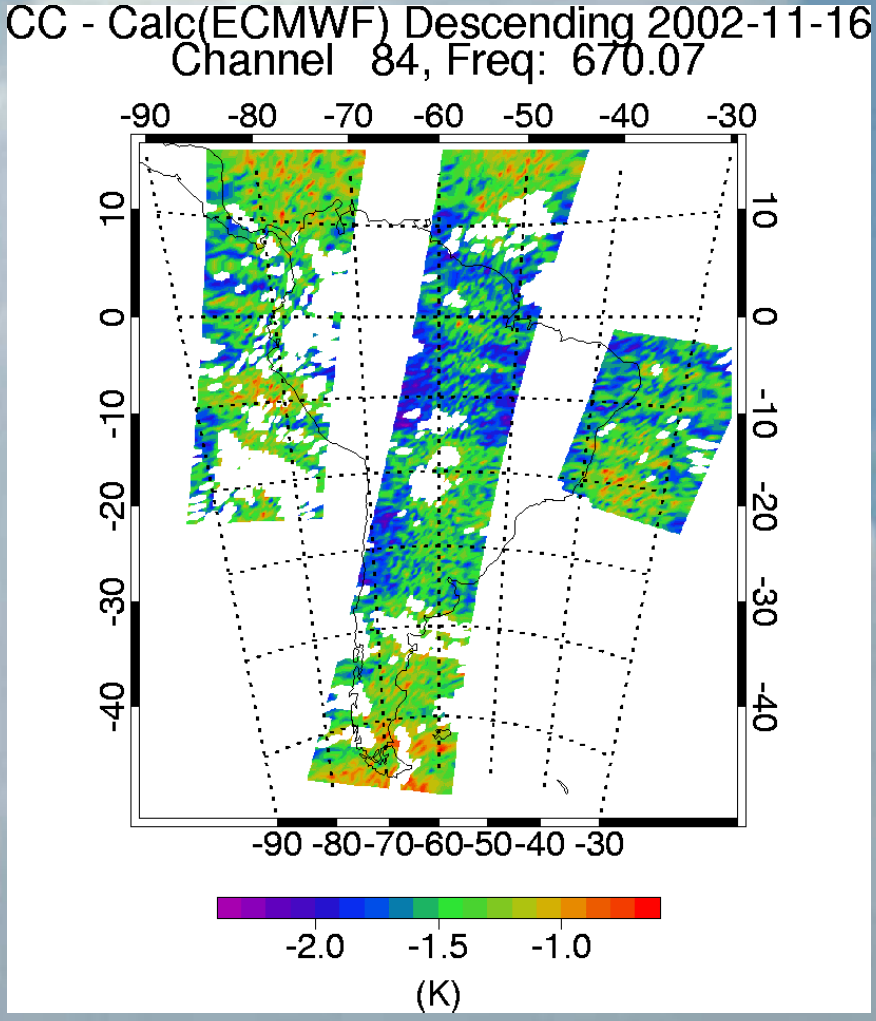


Channel 84 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 84, 670.35 cm^{-1} , 35 hPa**

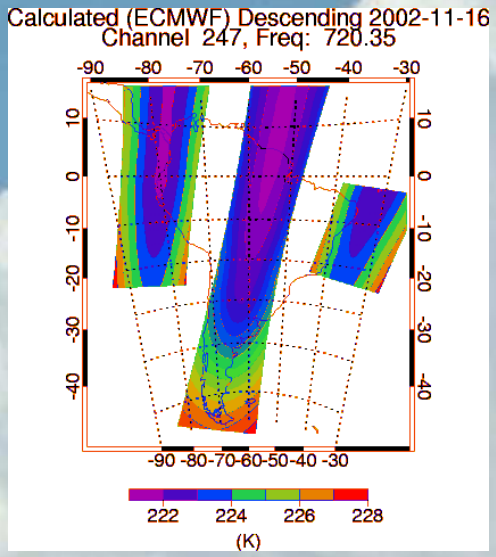


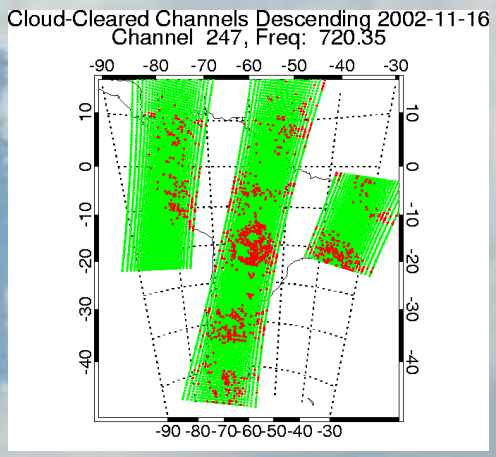


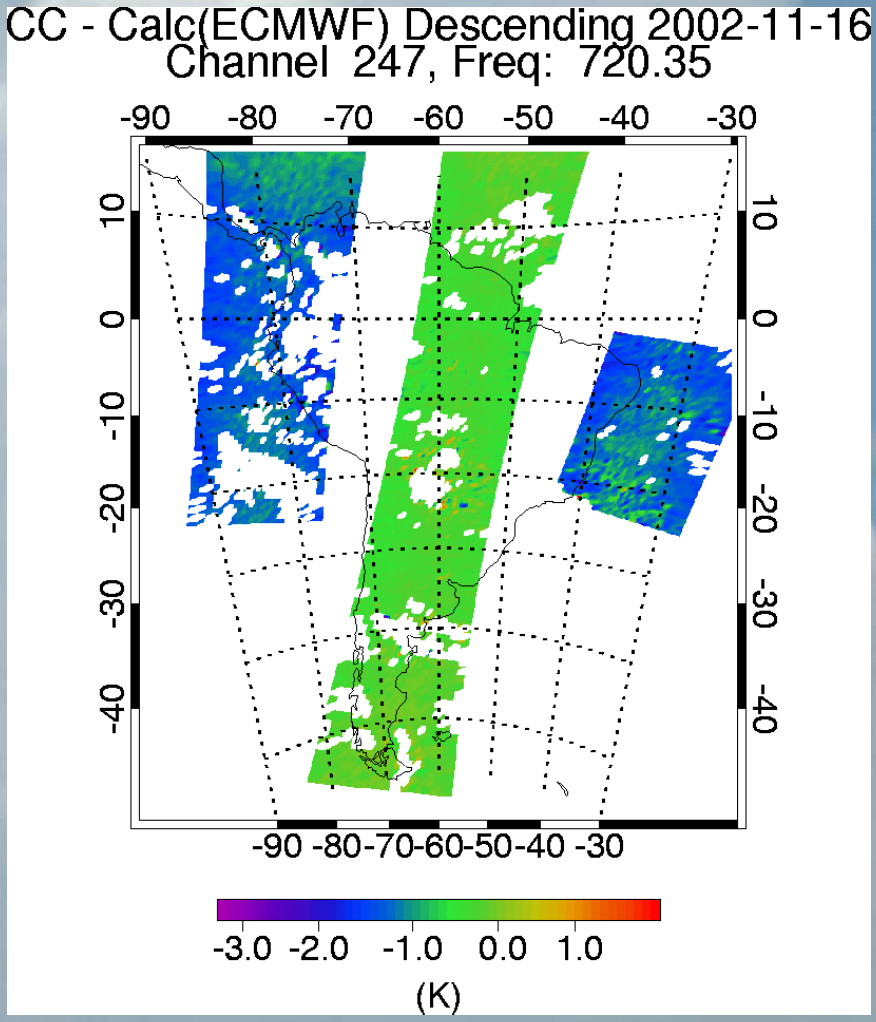


Channel 247 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 247 720.35 cm^{-1} , 40 hPa**

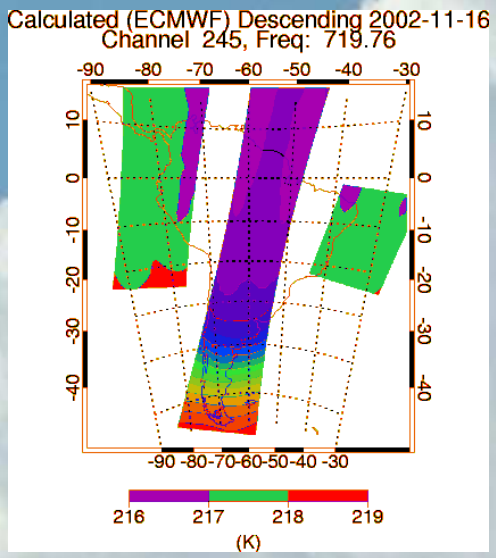


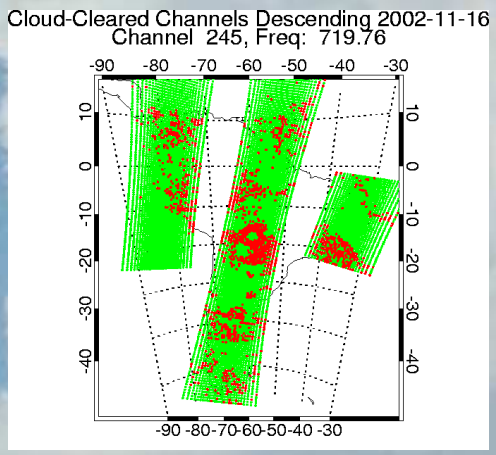


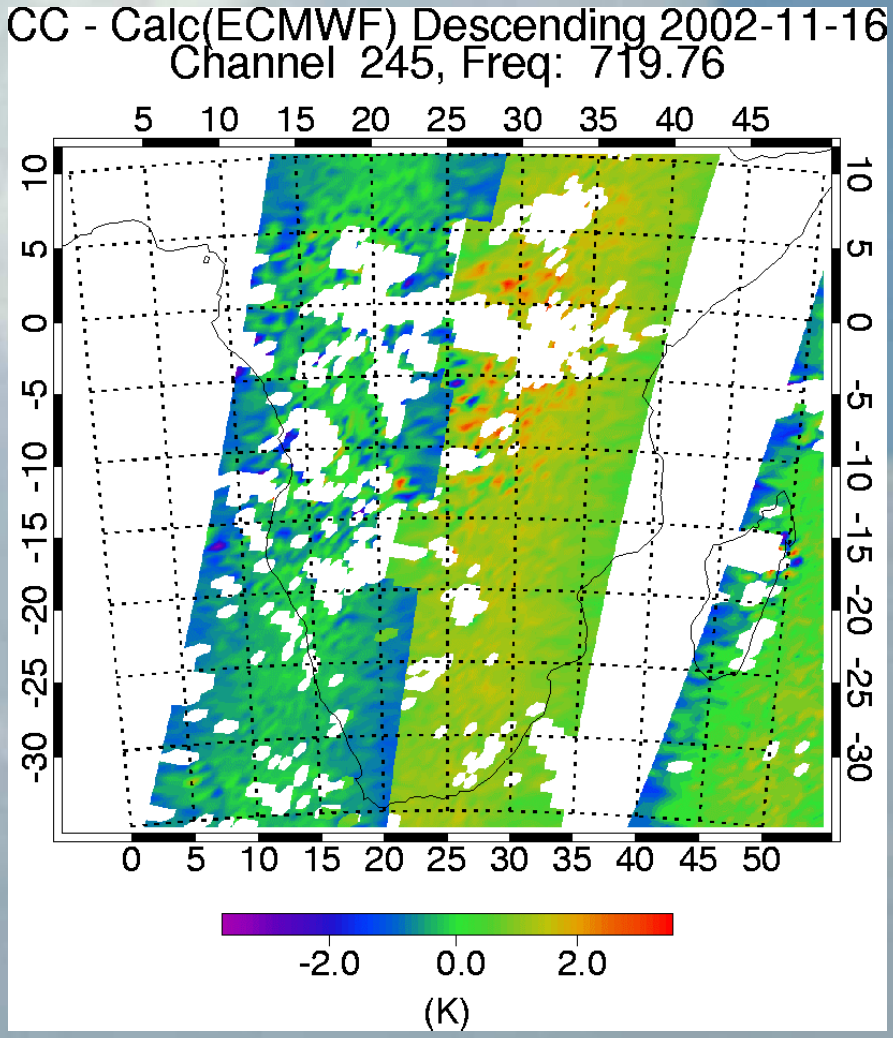


Channel 245 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 245, 719.76 cm^{-1} , 100 hPa**

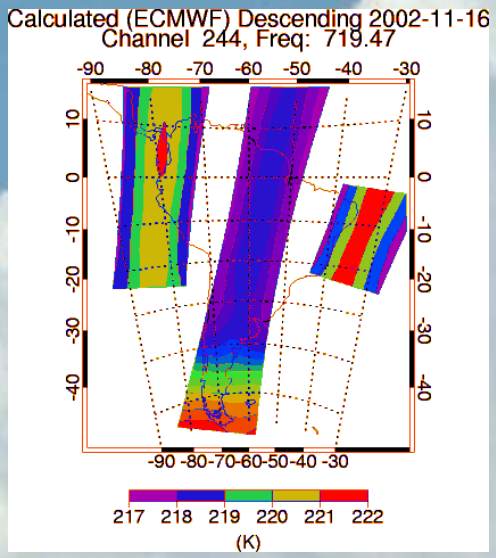


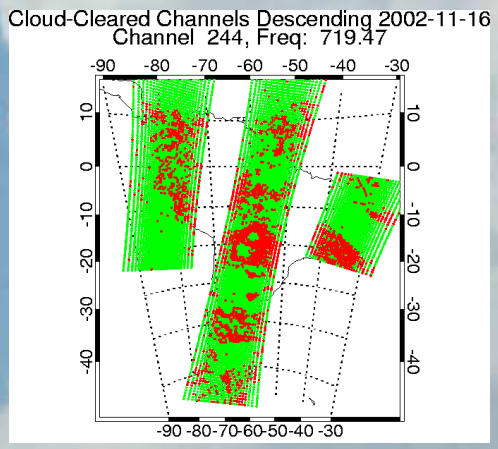


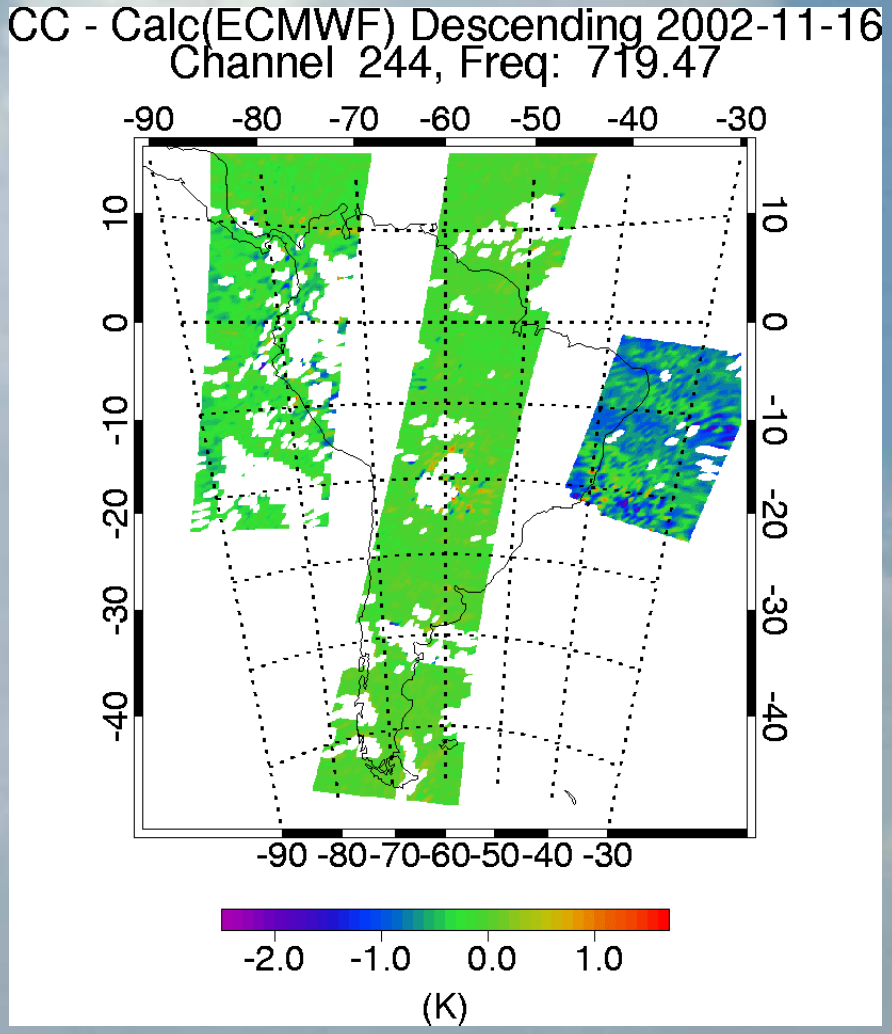


Channel 244 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 244, 719.47 cm^{-1} , 150 hPa**

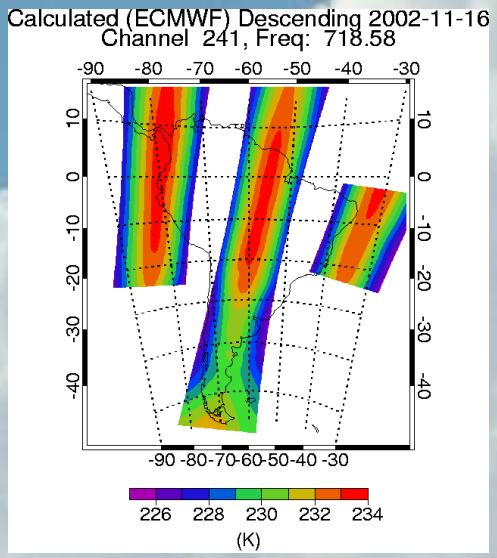


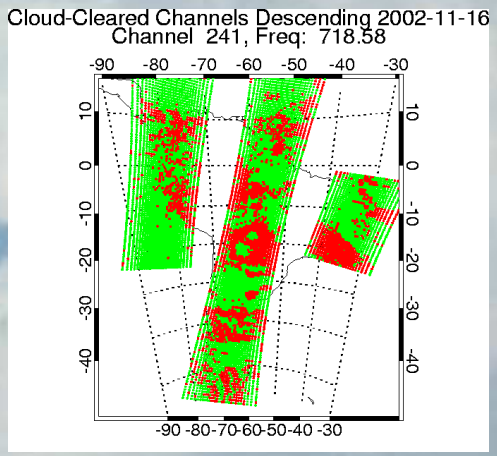


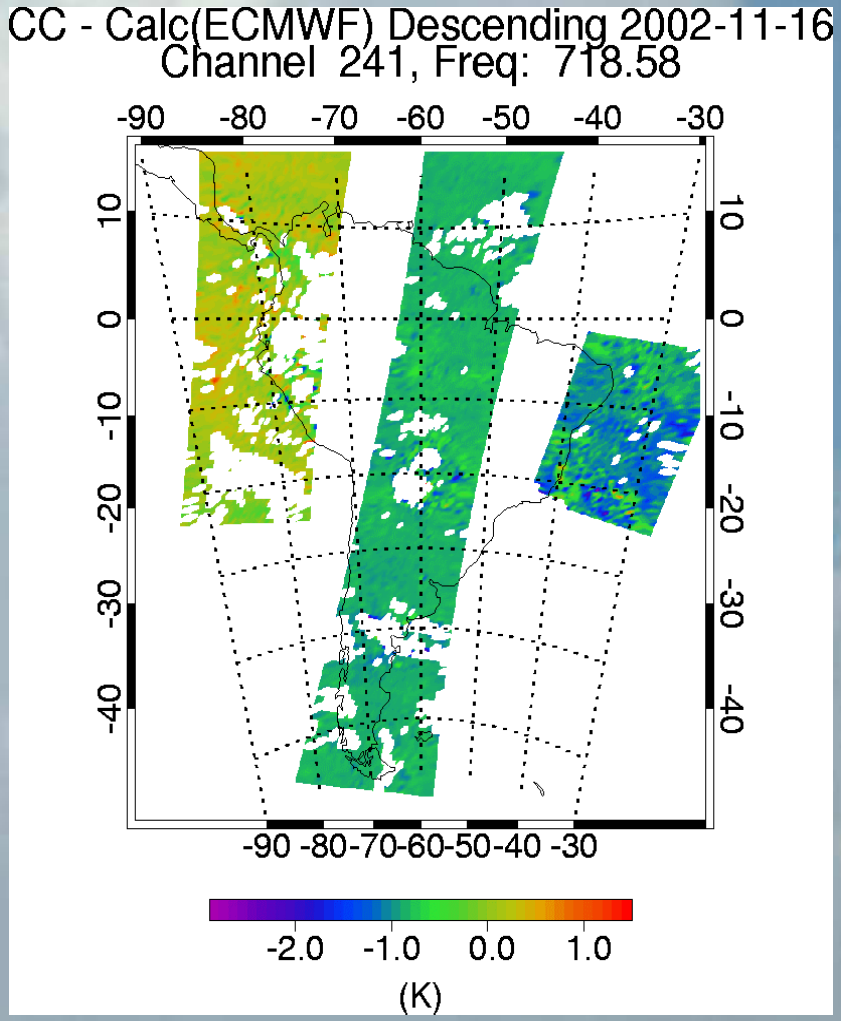


Channel 241 South America
Mapped CC – Calc (ECMWF) Differences

- **Channel 241, 718.58 cm^{-1} , 340 hPa**

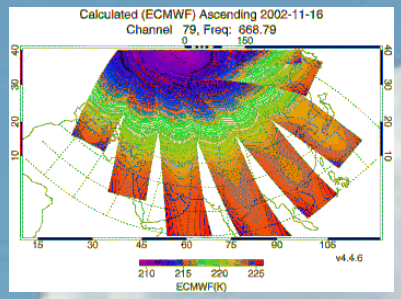


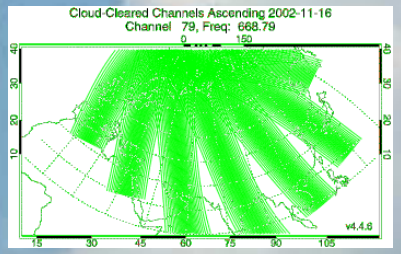


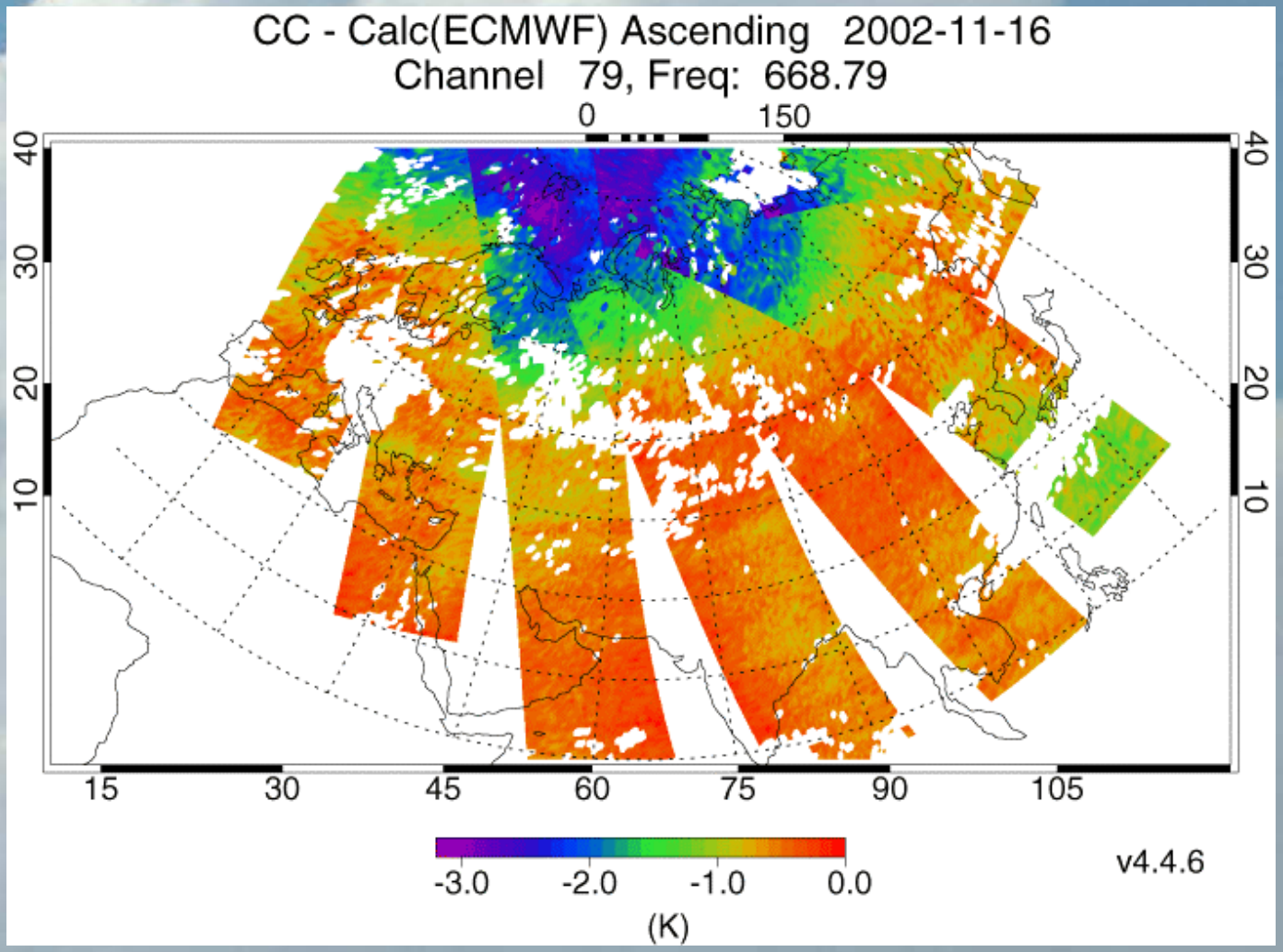


Mapped Calc(ECMWF) - CC Radiances
Asia Channel 79

Channel 79 668.79 cm^{-1} 12 hPa

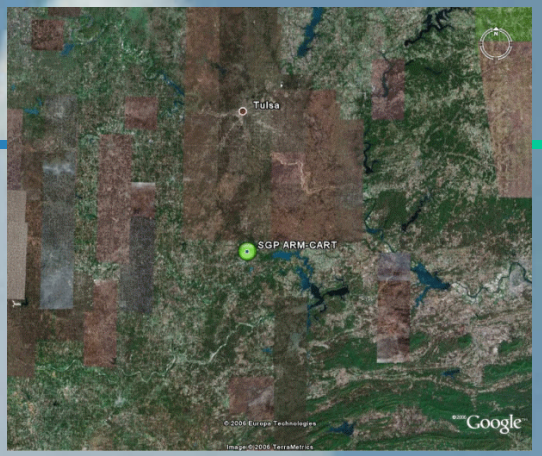


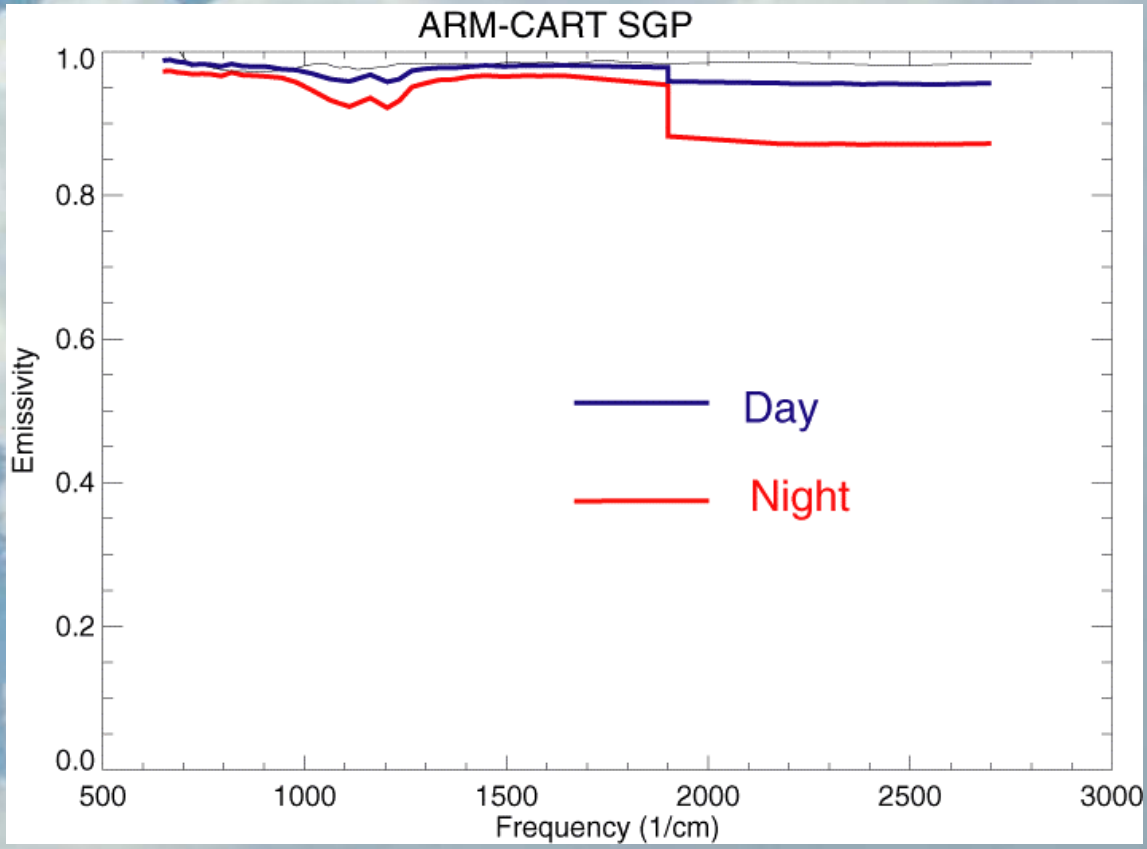




ARM-CART SGP

- 35°30’ N, 95°57’ W
- Mixed grassland, bare soil





ARM-CART SGP

- **CC – Calculated using retrieved states**